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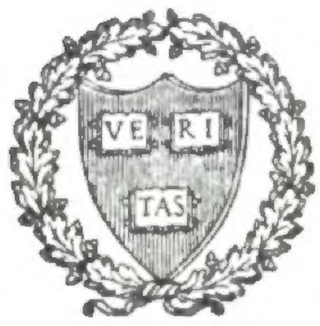

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for *Zool-* read *Zoöl-*
page 22, lines 19, 21 and 24
for middle-lobe read middle lobe
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for *Zool-* read *Zoöl-*
page 24, line 23
for middle-lobe read middle lobe
page 47, line 15
for or read on
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delete hyphen after anguste
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for deep read in diameter
page 61, footnote
for 78-80 read 84-86
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for 70 read 77
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for 67 read 73
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for *kotschoubeyanus* read *Kotschoubeyanus*
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for *disciformis* DC. read *disciformis* (DC.) Britton & Rose
page 82, line 21
for *tolucanus* read *toluccanus*
page 84, line 22
for *rungei* read *Rungei*
page 85, line 1
for *rungei* read *Rungei*
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for *Sophophora* read *Sophora*
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for *denegrii* read *Denegrii*
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for 2.65 mm. read 2.65 cm.
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for *Tropidia ctenophora* Reichb.f. read *Tropidia ctenophora* Benth. & Hook.f. ex Drake
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for Dutch read German
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for *1996* read *1995*
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for Mem. read Mém.
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page 138, line 31
for *guamensis* read *guamense*
page 140, line 2
for inverse-conic read conical
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after Form insert a period
page 174, line 19
for leaf-rhachis read leaf-rachis

Sci Scrapbooks

BOTANICAL MUSEUM LEAFLETS

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POLLINATION OF ORCHIDS THROUGH PSEUDOCOPULATION

BY

OAKES AMES

ILLUSTRATIONS BY BLANCHE AMES

WITHIN comparatively recent years, biologists have been made aware of a peculiar relationship between certain orchids and the hymenopterous insects which pollinate them. A wholly unexpected trend in biological behavior has been revealed and it has been proved that the motives leading to pollination are much more complex than formerly had been supposed. It is now known that certain insects are attracted by orchids for a purpose wholly apart from the search for food and that there are aspects of pollination presenting new and practically unexplored fields for research.

The historical approach to the subject of the pollination of orchids carries us back to what may be termed the beginning of the rational epoch in natural history, when guess-work and philosophical speculation were steadily giving ground to critical studies and reasoned research. Indeed, it was the mystery surrounding the methods of fecundation in the Orchidaceae that impelled Robert Brown to review the theories that had been propounded from 1760 down to 1831 and to examine the matter by actual observation. In the Transactions of the Linnaean Society for 1833 appeared Brown's famous

paper "On the Organs and Mode of Fecundation in Orchideae and Asclepiadeae" (Trans. Linn. Soc. 16 (1833) 685-733), and it was through his critical investigations of the tissues of orchids in the furtherance of his knowledge of this subject that he noticed for the first time the nucleus of the cell and in defining it, hit on the exact term which later became adopted in the vocabulary of science.

It is interesting to learn, from Brown's remarks, of the obscurity that once surrounded what is today so obviously and so definitely implied by the sexual apparatus of the most simple species. There were two schools of thought regarding the methods of fecundation in the orchids: one claiming that direct application of the pollen to the stigmas is necessary to bring about fecundation; the other regarding direct contact between pollen and stigmas too difficult of accomplishment or altogether improbable, and the proponents of this idea suggested other means than direct contact between pollen and stigmas by which the fecundating material reached the ovules. Brown concluded that the application of pollen to the stigmas is the only way in which impregnation of the ovules is effected, and referred to J. K. Wächter who was the first man to demonstrate experimentally that pollen must reach the stigmas if fertile seeds are to be produced and that if insects are excluded from the flowers fertile seeds fail to develop. This was in 1801.[1]

In 1862, before the Linnean Society of London,

[1] "Ich zog nämlich Orchis bifolia in der Stube in Topfe, und hielt, so viel wie möglich, Insecten und äussere Zufälle von den Blumen entfernt. Jede Anthere blieb in ihrer häutigen Einlassung verschlossen, dagegen nahm ich bey einigen Blumen die Antheren mit einer Pincette heraus, und befruchtete die Narbe. Nur bey diesen schwoll nach einiger Zeit das Germen auf, und trug eine grosse Menge Saamen; – alle übrigen blieben unfruchtbar." J. K. Wächter, Römer Archiv für die Botanik 2, (1801) 209.

Charles Darwin read a remarkable paper on the sexual forms of Catasetum, a genus of the Orchidaceae characterized by extraordinary dimorphism. In the same year his classic treatise on the relation between insects and orchids appeared. This comprehensive work, spiced with conjecture, gave the results of patient observation and not only banished all doubt regarding the function of the pollinia, but centered the attention of naturalists on the complex symbiosis existing between orchids and food-seeking insects. Since Darwin's treatise on orchid-pollination was published, there have been many contributions to the subject, but these have been scattered in various journals and have to do for the most part with single species.

One would be justified in concluding that the examples of pollination as Darwin described them for Catasetum and Coryanthes constitute the most complicated symbiotic relationships to be found in the orchid family; but the recent discoveries made by Pouyanne, Godfery and Mrs. Edith Coleman have revealed equally complicated relationships and have indicated the necessity for close scrutiny of the behavior of insects that pollinate orchids.

In February 1916, in the Journal de la Société Nationale d'Horticulture de France there appeared the first of a series of articles contributed by Monsieur A. Pouyanne and submitted to the Society by Monsieur Henry Correvon. Pouyanne, during his long residence in Algeria where he served as President of the tribunal of Sidi-Bel-Abbès, had observed the pollination of several species of Ophrys and had arrived at truly startling conclusions; indeed, he had arrived at conclusions so startling that painstaking confirmation, carried on through twenty years, preceded their publication.

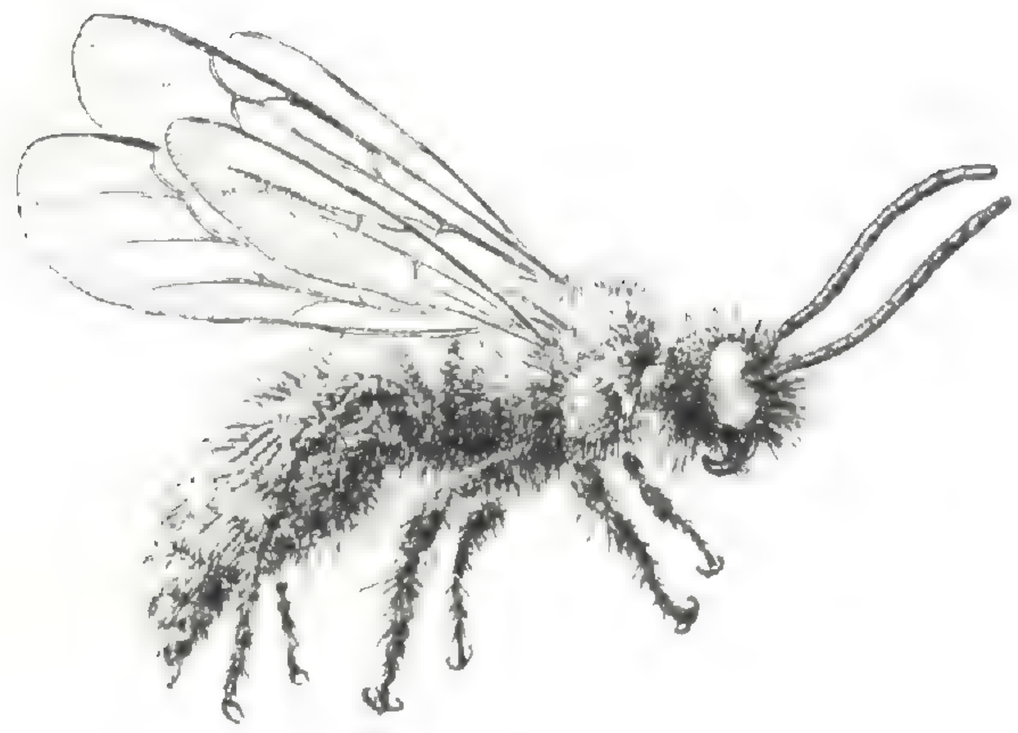
Pouyanne observed pollination in *Ophrys speculum*

Link, *O. fusca* Link and *O. lutea* Cavan. He learned that the flowers of *Ophrys speculum* are visited not only by a single species of insect, *Scolia (Dielis) ciliata* (Fabr.),[2] but solely by the males. The females exhibited complete indifference to the orchid although visiting the flowers of species of Centaurea, Galactites, Malva and Reseda in search of food. Both sexes visit species of these genera and both the males and females then use the proboscis in sipping nectar.

Scolia ciliata is a member of the Scoliidae, a family of burrowing hymenoptera, whose burrows are made in sand-banks exposed to the sun. The males emerge from the burrows about a month earlier than the females, usually in March. The females lead an almost subterranean existence and leave the burrows chiefly in search of food. While waiting for the females to make their appearance (mating takes place only in the open air), the males may be seen exploring in sinuous flight the ramparts of Algerian fortifications and exposed railroad embankments. And it is just such places as these for which the plants of *Ophrys speculum* exhibit a predilection. The flowering season of the orchid coincides with the appearance of the males of *Scolia ciliata* and during the long wait for the coming of the females, the male insects visit the orchid flowers, seeming to find in them a compelling attraction. There were questions here demanding deep thought. In the first place, why the indifference of the females? And in the second place, what attributes peculiar to *Ophrys speculum* were of a nature to attract one sex and not the other of an insect seeking food?

Pouyanne established beyond any doubt that the flowers of *Ophrys speculum* are not visited for nectar or

[2]Pouyanne referred to this insect as *Colpa aurea*. In more recent accounts the name *Dielis ciliata* Fabr. has been used. In this paper I have adopted the view that Dielis is a subgenus under Scolia.



1. Scolia (Dielis) ciliata *(Fabr.)*
A male, three times natural size.

2. Ophrys speculum *Link.*
A flower, three times natural size.

edible tissues, because when the males of *Scolia ciliata* enter a flower the suctorial apparatus is not used and the proboscis of the insect does not come in sustained contact with any part of the labellum of the orchid. The insect assumes a position lengthwise of the labellum with the head directed toward the column, just beneath the rostellum, and inserts the tip of the abdomen among the reddish yellow or maroon colored hairs that form a fringe near the apex of the labellum. While in this position, peculiar movements of the insect's body take place; the pollinia of the orchid are dislodged and are affixed to the insect's head. After the usual hygrometric behavior of the pollinia the pollen masses are in a position for coming in contact with the stigmas of the next flower visited. Pouyanne observed the action of the insect after the tip of the abdomen had been inserted among the hairs of the labellum and described it as follows: "Le bout de l'abdomen est alors agité, contre ces poils, de mouvements désordonnés, presque convulsifs, et l'insecte tout entier se trémousse: ses mouvements, son attitude paraissent tout à fait semblables à ceux des insectes qui pratiquent des tentatives de copulation."

Seeking to explain the behavior of the males of *Scolia ciliata*, Pouyanne conducted a series of experiments that might prove enlightening. He cut off the labellum of some of the flowers, leaving the sepals, petals and column intact. Flowers so mutilated were neglected: the insects became quite indifferent to them. If single flowers were taken from a raceme and placed on the ground, they were immediately approached. But when the separate flowers were inverted with only the under side of the labellum exposed, the insects still came to them, yet with lessened interest. If a bouquet of flowers was held in the hand, the males of *Scolia ciliata* came to it in numbers, contending with each other for the possession of a labellum. If,

however, such a bouquet was forced on the attention of the females, they exhibited indifference, and if pressed too insistently flew away as if from something repugnant to them. If flowering specimens of the orchid were concealed under sheets of newspaper and thus hidden from view, the males of Scolia would approach, as if trying to reach the concealed flowers, attracted, it would seem, by some odor too faint for perception by human nostrils, because *Ophrys speculum* is described as being without scent. Pouyanne refers to the metallic, violet-blue patch of color on the labellum of *Ophrys speculum* as resembling the metallic blue of the female of *Scolia ciliata* when, at such times as the insect is at rest or crawling on the ground, the wings are half crossed. It is then that the insect, if the sun is shining, exhibits a metallic lustre, an iridescence, similar to that of the labellum of *Ophrys speculum*. Even though the resemblance between the female of *Scolia ciliata* and the labellum of the orchid is hardly of a nature to deceive our eyes, Pouyanne reminds us that the vision of insects is myopic and less keen than ours and that, moreover, in addition to even a faint resemblance that might not in itself deceive the males of *Scolia ciliata*, there is some subtle scent that completes the deception and induces the sexual phenomena he has so convincingly described.

From Pouyanne's experiments and from the behavior of the insects there was every reason to believe that *Ophrys speculum* and the males of *Scolia ciliata* are biologically adjusted for purposes mutually advantageous, although if the purposes are purely sexual, as is evident, then the orchid alone seems to be biologically benefited by the association and, according to human standards, the insect seems to be sadly hoodwinked.

We may wonder how the brief time between the emerging of the males and the females of *Scolia ciliata*,

about thirty days each year, was turned by the plant through the ages to such advantage to itself, because in seasons when the orchids are late in flowering or the females of *Scolia ciliata* emerge from their burrows earlier than usual, the orchids are neglected and yield few if any seeds. And once the females of *Scolia ciliata* appear, the males apparently lose interest in the orchid-flower and pseudocopulation is no longer performed. Here indeed is a circumstance that is rather amazing. It forces us to assume gradual change and a series of slow modifications through a prodigiously long period of time before the male insect and the orchid became biologically adjusted. Is it not true, that in contemplating the action of Natural Selection as Darwin propounded the doctrine, we think of modifying influences as being prolonged or in constant operation on the affected organism? And yet the direct stimuli associated with pseudocopulation that have affected the flowers in the case of *Ophrys speculum*, have been confined in their action to the brief flowering period, to the duration of anthesis, and under certain circumstances, in exceptional seasons, may operate for a very limited time.

After studying the relationship between *Ophrys speculum* and *Scolia ciliata* it would seem that the marvels of orchid-insect symbiosis had reached the furthermost limit of specialization, but such is not the case, because the observations of Monsieur Pouyanne in Algeria and of Colonel M. J. Godfery at Hyères in the south of France, on other species of Ophrys, and the observations made by Mrs. Edith Coleman in Australia with regard to the pollination of *Cryptostylis leptochila*, through symbiotic relations with an ichneumonid wasp, throw the whole matter of sexual relationship between orchids and insects into the realm of fascinating conjecture and stimulate the belief that in some departments of orchidology we are

simply at the threshold of enlightening investigation.[3]

As in other fields of human experience, so in biology, it seems that unusual discoveries are announced almost simultaneously. Pouyanne may have formed very definite conclusions regarding *Ophrys speculum* many years before he published the results of his observations in 1916, but the first reference to this symbiotic phenomenon was followed in 1925 and in 1927 by the announcements of the independent observations of Godfery in France and of Mrs. Coleman in Australia.

Usually when we describe the pollination of orchids by insects we explain that the pollinia become attached to the insect's proboscis, head or thorax and that this is so because the insect enters the flower head foremost and eventually comes in contact with the rostellum, that extraordinary third stigma, or female organ, modified to serve as an efficient means of attachment of the pollinia to the insect. But this is not always so. There are cases,

[3]Robert Brown was of the opinion that the flowers of *Ophrys apifera* resemble bees to repel, not to attract, insects. Darwin in a footnote in his treatise, On the various Contrivances by which British and Foreign Orchids are fertilised by Insects, has the following: "Mr. Gerard E. Smith, in his Catalogue of Plants of S. Kent, 1829, p. 25, says: 'Mr. Price has frequently witnessed attacks made upon the Bee Orchis by a bee, similar to those troublesome Apis muscorum.' What this sentence means I cannot conjecture." It is possible that we have here the first reference to pseudocopulation between insects and orchids.

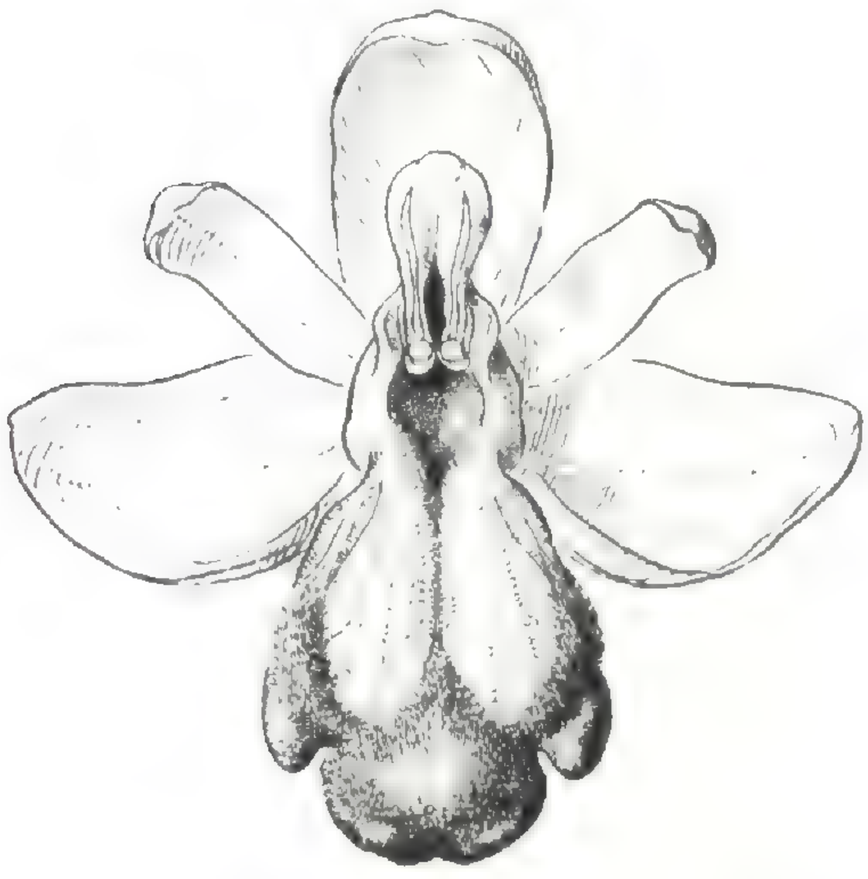
In the Journal of Botany (68 (1930) 280-281) H. G. Willis directs attention to pollination in the Fly Orchis *(Ophrys muscifera)*, stating that he saw a fly visit this species in 1877 and that a few years later an account of his observations was published in the Transactions of the Manchester Microscopical Society reporting him as having said, "To me at the time it seemed obvious that the male fly came to the flower mistaking it for a female." Godfery has observed pollination in this species effected by the males of *Gorytes mystaceus* L., the insects behaving in a manner that suggested a preliminary phase of courtship. (Journ. Bot. 67 (1929) 299).

rare indeed, when the insect inserts its *abdomen* between the rostellum and the base of the labellum and removes the pollinia on the posterior part of the body. If this occurrence proved to be strictly localized, we might accept it without too much concern; but when we find that it is not localized but takes place in the Mediterranean region and also in Australia, it becomes a matter fraught with fascinating biological significance.

In *Ophrys speculum* the labellum resembles an insect with its head facing the column and when *Scolia ciliata* enters the flower it does so head foremost. But in *Ophrys lutea*, a species observed by Pouyanne in Algeria, the labellum has in its centre certain markings that he described as being similar to the female of an insect with its head directed toward the apex of the labellum. When the males of species of Andrena visit the flowers (and here indifference on the part of the females is again to be noted), they assume what may be termed a reverse position, the abdomen being directed toward the column, the head toward the apex of the labellum. The insect inserts the tip of the abdomen in the cavity at the base of the labellum and after executing movements suggesting sexual excitement, departs bearing the pollinia *on the tip of the abdomen*. The same phenomenon has been reported for *Ophrys fusca* by Pouyanne, and by Godfery who observed insects visiting this orchid in the garden of the Hôtel Continental at Hyères. Godfery also observed *Andrena trimmerana* Kirby visiting *Ophrys arachnitiformis* Gren. & Phil. at Hyères. In this case the insect removed the pollinia on its head, but when it visited *Ophrys fusca* it carried the pollinia on the tip of the abdomen, having assumed the reverse position on entering the flower. As a result of the observations of Pouyanne and Godfery, it is apparent that *Ophrys speculum* is visited only by the males of *Scolia ciliata* which remove the pol-

3. Andrena nigroaenea *Kirby*
A male, three times natural size.

4. Andrena trimmerana *Kirby*
A male, about three times natural size.



5. Ophrys fusca *Link.*
A flower, three times natural size.

linia on the head; *Ophrys lutea* is visited by the males of *Andrena nigro-olivacea* Dours and *Andrena senecionis* Perez, and *Ophrys fusca* only by the males of *Andrena trimmerana* Kirby and *Andrena nigroaenea* var. *nigroseriea* Dours, all of these insects entering the flower in the reverse position and removing the pollinia on the tip of the abdomen.

In Australia, in May 1927, Mrs. Coleman published a preliminary statement, in the Victorian Naturalist, describing the behavior of the Ichneumonid wasp *Lissopimpla semipunctata* Kirby which visits the orchid *Cryptostylis leptochila* F. v. Muell., but she refrained at that time from giving free expression to the conclusions she must have drawn, and simply stated two facts: that the insect visits the orchid and assumes the reverse position: that the insect effects pollination. In the following year (April 1928), Mrs. Coleman published a second paper in the Victorian Naturalist, giving a detailed account of further observations on *Cryptostylis leptochila*. Her conclusions were so extraordinary that they would have justified incredulity had not the opinions of other investigators substantiated them. She linked the Australian case with the ones observed in Algeria and France. There was no doubt in her mind but that the orchid flower, through what she termed mimiery, exercises sexual attraction for the males of *Lissopimpla semipunctata* and she assumed that mimiery of form is reinforced by a scent too faint for perception by human beings.

Besides the lure of "mimiery" it is indeed highly probable that the orchid gives off a scent that produces a stimulus at a distance because the flowers, even when taken into a room with partially closed windows, are visited by the males of *Lissopimpla semipunctata*. On one occasion when flowers were placed on a shelf beneath a window they were visited almost instantly by three

males, surely evidence that scent plays a part in this remarkable relationship between orchid and insect, notwithstanding the reports that *Cryptostylis leptochila* is odorless or emits only a faintly perceptible odor.

After studying such subtle modifications, we are reminded of Darwin's words: "Unless the flowers [of orchids] were by some means rendered attractive, they would be cursed with perpetual sterility."

A glance at the strange labellum of this Cryptostylis, modified out of all proportion to the almost thread-like sepals and petals, with its double row of dark glistening glands that gleam in the hot sunshine loved by the wasp, is perhaps sufficient to justify the theory of an attraction based on the resemblance of the flower to a female Lissopimpla. The male wasp always assumes the reverse position with the head facing the apex of the strongly sigmoid labellum. It opens the tip of the abdomen, apparently fastens the claspers to the fleshy folds of the labellum at the base and thrusts the aedoeagus into the stigma, when seminal fluid is ejected. In the meantime the tip of the abdomen has been pressed against the viscid disc of the rostellum and when the insect departs it carries the pollinia fastened to the posterior part of the abdomen. Tarlton Rayment in his recent book "A Cluster of Bees" gives a brief description of this phenomenon and thus lends the weight of his entomological knowledge to the conclusions at which Mrs. Coleman arrived.

One might be led to expect that *Cryptostylis leptochila*, through its association with *Lissopimpla semipunctata*, would exhibit a distribution similar to that exhibited by the insect. But this is not so. Lissopimpla is found in all the Australian States and also in New Zealand, while *Cryptostylis leptochila* is confined to Victoria and New South Wales, its capacity for spreading being limited by those factors that govern endemism. Yet if the orchid

is taken to localities beyond its natural range, the males of *Lissopimpla semipunctata* will visit the flowers and behave toward them in the manner described above. It is now known that *Lissopimpla semipunctata* does not confine its attentions to *Cryptostylis leptochila*, but pseudocopulates with three other Australian species of the genus: *C. subulata* Reichb.f., *C. erecta* R. Br. and *C. ovata* R. Br.[4] possessing as it were an orchidaceous harem.

While Ophrys is essentially a European group with a few outlying representatives in western Asia and northern Africa, and includes approximately twenty-nine species, Cryptostylis extends from India to the South Sea Islands and comprises about thirty species. Cryptostylis is one of two genera referred by Rudolf Schlechter to the Cryptostylideae, a subtribe rather sharply set apart from its generic allies. This taxonomic isolation of Cryptostylis is significant when regarded in the light of Mrs. Coleman's observations. Its wide distribution in the tropics stimulates the expectation that when further studies are made of the methods by which the other species are pollinated, new and equally startling relationships may be revealed.

Since 1916 when Pouyanne's observations were published, pseudocopulation has been recorded for at least six species of Ophrys and for four species of Cryptostylis. As Ophrys and Cryptostylis belong respectively to two of the basic subdivisions of the monandrous orchids and are widely separated, each the product of a distinct line of descent, it is evident that pseudocopulation was either a primitive development in the Orchidaceae or originated

[4]Mrs. Coleman has described the visits of an insect to another Australian orchid, a species of Caladenia, and implies that pseudocopulation is performed, although as yet the identity of the insect has not been established and the actual removal of pollinia has not been observed. The Victorian Naturalist 46 (1930) 203-206.

independently more than once as a symbiotic phenomenon; not only independently with regard to the phylogenetic position of the genera affected, but with regard to the geographical distribution of those genera. The assumption that pseudocopulation has had an independent origin phylogenetically and geographically, arouses the thought that there is perhaps some prevalent attribute of the Orchidaceae, aside from any morphological character, that permeates the species and underlies orchid-insect symbiosis.

It is illuminating to examine the evolutionary significance of pseudocopulation in the light of taxonomic evidence because, of the forty-five genera constituting the Basitonae or Ophrydean orchids, Ophrys is regarded as being the most primitive genus, while, of the three hundred and sixty or more genera constituting the Acrotonae, Cryptostylis is ranked as being the thirtieth genus. Allowing for differences of opinion, and in this case they are delightfully negligible, the positions assigned to Ophrys and Cryptostylis indicate that pseudocopulation, no matter what future studies and discoveries may reveal with regard to its occurrence, is a peculiarity of the lowest groups of the orchid family and therefore may be considered an ancient and long established association. For this supposition one might expect to find helpful evidence in the paleobotanical record, but there are not any fossil orchids, notwithstanding Massalongo's Protorchis and Palaeorchis from the Eocene of Monte Bolca. Although these may be regarded as being Monocotyledons, they are wholly doubtful orchid concepts. The orchids, probably as a result of sparse distribution, appear either to have eluded the processes of fossilization or to have escaped detection. As for the insects known to be associated with pseudocopulation, none of the species has been recorded in the fossil state although the genus Andrena

is very ancient and is represented in Baltic amber. However, in appraising the value of the evidence supplied by fossils with regard to the antiquity of particular genera and species, we have to urge caution regarding the significance of negative evidence because fossils in museum collections constitute a pitifully incomplete record of the past.

From the known examples of orchid-insect symbiosis it becomes clear that orchids have derived profit from two of the dynamic urges of animals: *hunger and sex*. In Coryanthes and Catasetum the pollinating insects seek food. The flowers of these genera have developed edible tissues that attract certain bees, and in the course of evolution their floral structures have become so modified that food-seeking bees bring about pollination. In Ophrys, on the other hand, where nectar is wanting, and in several of the better understood members of this genus which seem to lack edible tissues, it is not the urge of hunger that motivates the insects necessary to effect pollination, but the equally dominant sex-impulse. Probably in the course of evolution, these orchids gradually lost the capacity to produce nectar or edible tissues and by some passive response to stimuli incident to the dynamic sexual urge of certain insect-visitors became so modified in structure that they seem to simulate the female of a particular insect species. In this connection it is difficult to escape the conclusion that such orchids as *Ophrys speculum*, by "mimicking" the female, in becoming by evolution dependent for pollination on the male of a single species of insect, have been marvellously even if perilously specialized.[5] In the final analysis there is something

[5] *Ophrys speculum* is a widely distributed species in the Mediterranean region and it is not at all improbable but that as its pollination history becomes better known we may find other insects associated with the transportation of the pollinia.

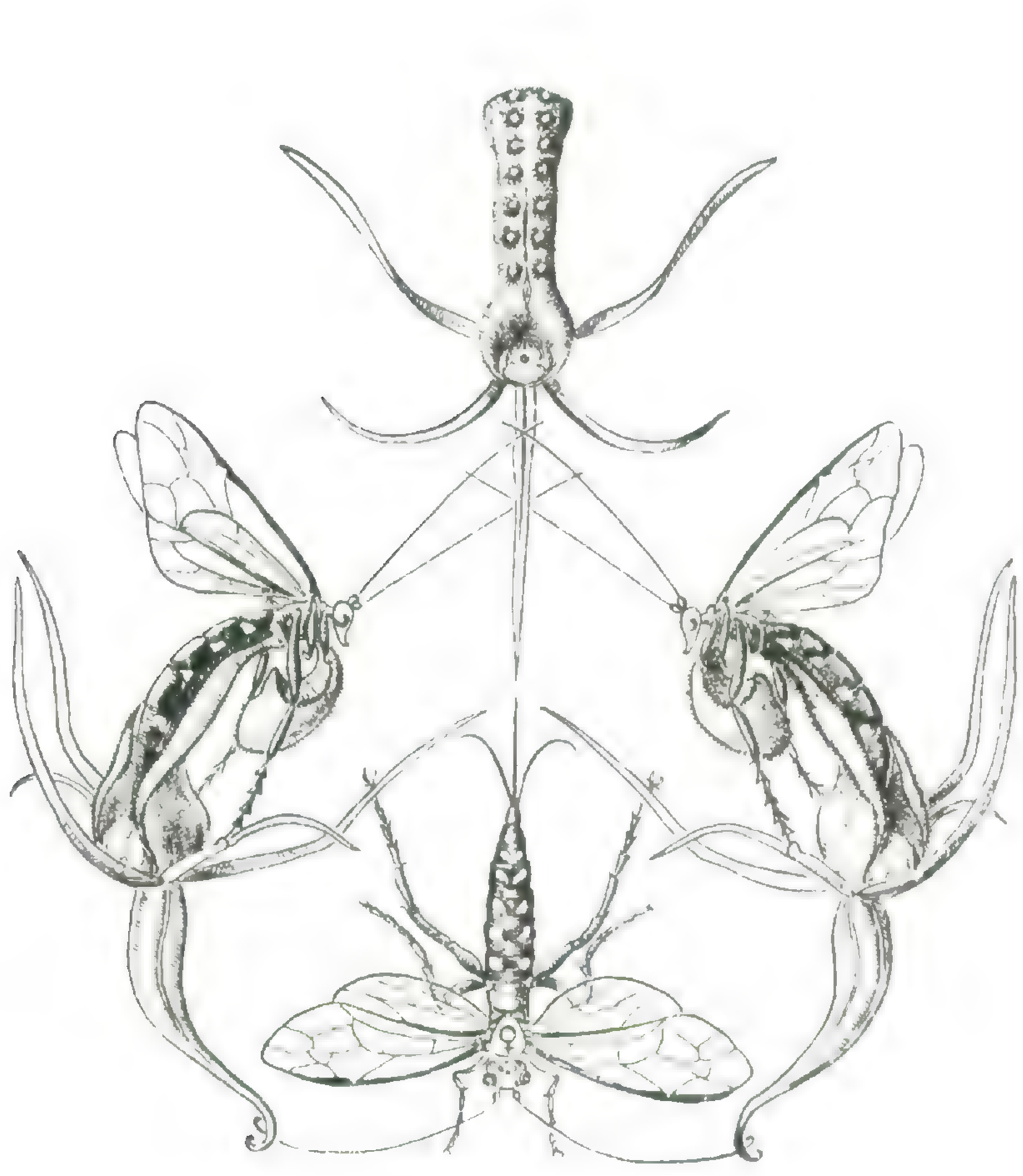
definitely awe-inspiring in the pollination-history of the orchids when it is understood that to ensure their sexual success there has been developed subserviency to two of the dominating instincts of animals: *the urge of hunger and the sexual impulse.*

Before us is a teasing question. It arouses keen curiosity and stimulates the wish to know more than we do about the actual history of biological change, not only as it relates to the origin of species but to the actual shaping of flowers. Perhaps it is easy to visualize gradual change in form where structures are supposed to be continually responding to environmental influences until complexity replaces simplicity, but when into the theatre of our imagination we usher such organisms as *Ophrys speculum* and *Scolia ciliata* and command them to play out their evolutionary story and exhibit how the duration of anthesis has been long enough to bring about the phenomena we have witnessed, it must always be in the dim light of limited understanding.

Biology is the study of protoplasmic manifestations whether these occur in structure or in behavior. Man being the only animal trying to explain itself and to ascertain the laws of destiny, tries to explain everything else. After asking pertinent questions about the obscure forces responsible for the wonderfully close association between the Ichneumonid wasp and Cryptostylis, Tarlton Rayment answered: "Who knows?" And that I fear will be the answer despite our present knowledge of tropisms and the play of hormones, even should more venturesome naturalists endeavor to plumb the depths of the pseudocopulation mystery.

It may be that those who would reject the evolutionary approach to an understanding of life and who prefer to regard the world as the product of Special Creation will lean a little more lightly on human weakness when

they discover moral turpitude among the insects. And it may be that entomologists, who see for insect societies parallels in human institutions, will become Freudian in their outlook when discussing the sexual vagaries revealed by symbiotic phenomena and introduce such terms as *Lissopimplan behavior* or *Ophryidean complex*. Perhaps even the poet will have to reconsider whether "Only man is vile."



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EXPLANATION OF THE ILLUSTRATIONS

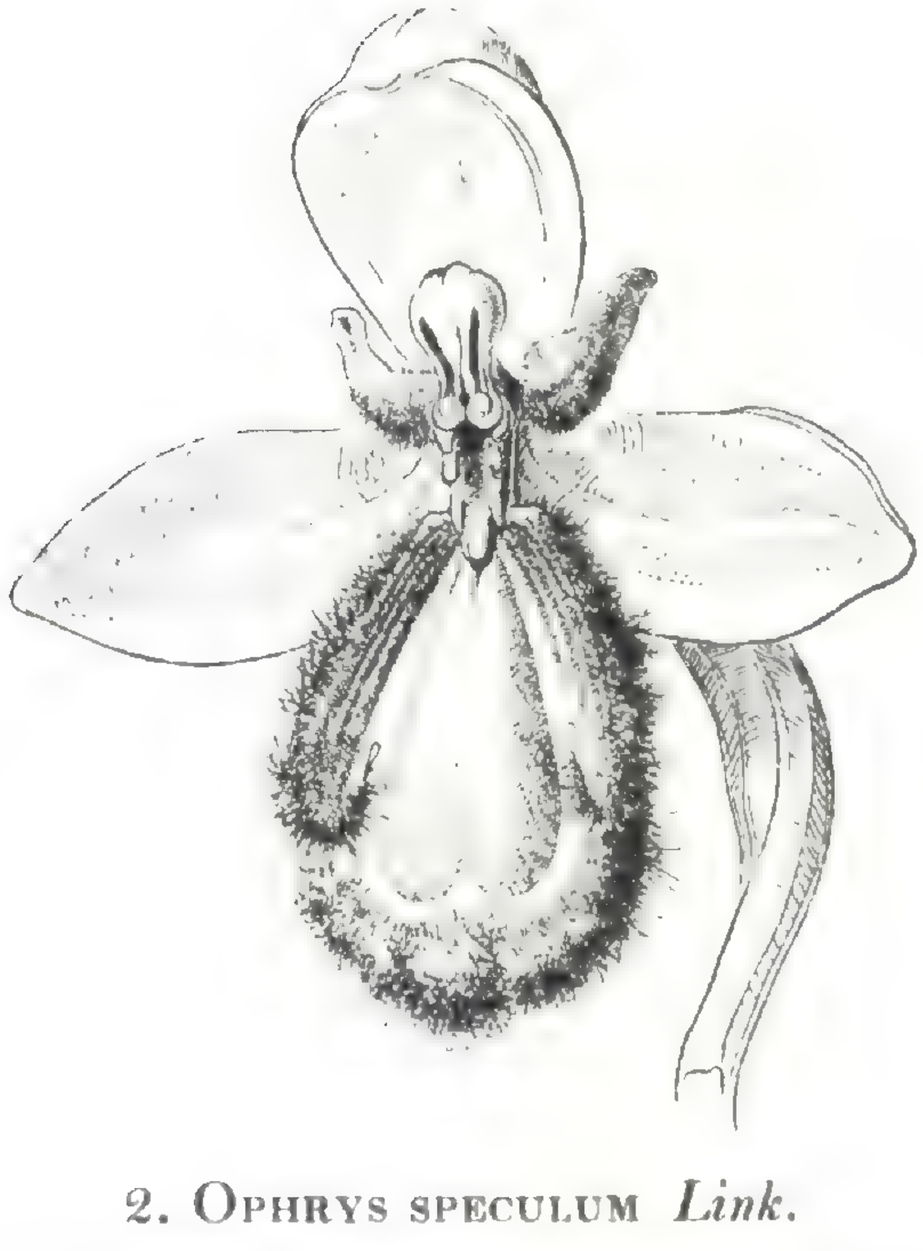
1. Scolia (Dielis) ciliata *(Fabr.)*. A male. The insect is enlarged approximately three times natural size. The body of the insect is black with bristle-like, light brown or yellowish hairs on the thorax, abdomen and legs.

Drawn from a specimen preserved in the Museum of Comparative Zoology, Harvard University.

2. Ophrys speculum *Link*. A single flower enlarged approximately three times natural size. Sir J. D. Hooker (Botanical Magazine t. 5844) referred to the labellum of *Ophrys speculum* as follows: "the brilliant polished surface of the disc of the lip, which shines like a blue-steel looking-glass, edged with gold, and that again set in a rich maroon velvety frame, presenting a combination of colours quite unlike anything else known to me in the vegetable kingdom."

The relative lengths of the body of *Scolia ciliata* and of the labellum of *Ophrys speculum* appear to be so nicely adjusted that the insect's head comes directly under the rostellum of the flower when the tip of the abdomen is thrust among the hairs near the apex of the large middle-lobe. In this regard, and as a product of Natural Selection, the labellum of the orchid is a most interesting structure, because the marginal portion of the middle-lobe is comparatively smooth and sharply deflexed, the elongated hairs ceasing rather abruptly at the point where deflexion begins. In the illustration the marginal, smooth portion of the middle-lobe is invisible because of its being rolled downward. The rostellum (represented in the illustration by the two rounded structures at the base of the balloon-like anther situated between the two short petals) is at just the proper height (about 2 mm.) above the base of the labellum where it joins the column, to allow the insect's head to pass beneath it, but in contact with it, when the pseudocopulative attitude is assumed. There is hardly any excavation at the base of the labellum comparable to the wide-mouthed cup or depression in *Ophrys fusca* and *O. lutea*, so that the "reverse position" is not favored.

1. Scolia (Dielis) ciliata *(Fabr.)*
A male, three times natural size.



2. Ophrys speculum *Link.*
A flower, three times natural size.

3. Andrena nigroaenea *Kirby*. A male enlarged approximately three times natural size.

Drawn from a specimen preserved in the Museum of Comparative Zoology, Harvard University.

4. Andrena trimmerana *Kirby*. A male enlarged approximately three times natural size.

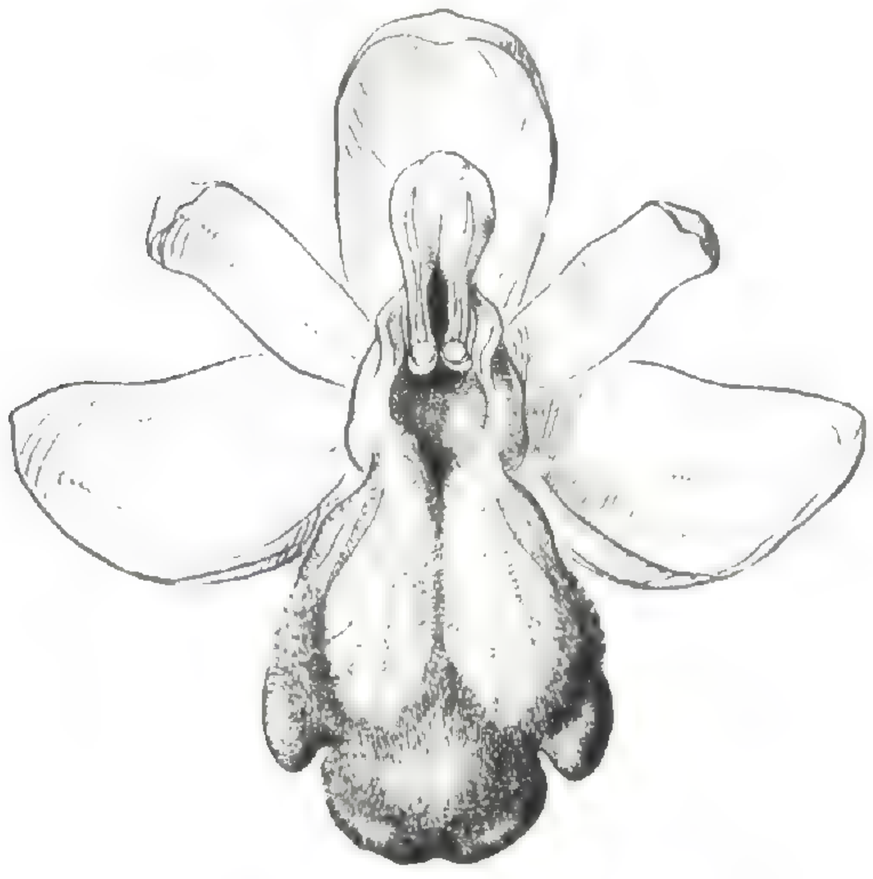
Drawn from a specimen preserved in the Museum of Comparative Zoology, Harvard University.

5. Ophrys fusca *Link*. A single flower enlarged approximately three times natural size. The labellum varies considerably in color, but is usually dark purple, sometimes with a narrow golden yellow border. The markings that are supposed to simulate the wings of a female Andrena (probably the partly folded wings), are lighter in color than the rest of the labellum and are more or less iridescent with greys and blues. The wing-like pattern formed by the iridescent area is in reality densely beset with minute glandular hairs, but these are so minute that to the unaided eye the surface from which they emerge appears to be quite smooth. The rest of the labellum is velvety or even hairy almost to the margin and under the microscope is sharply demarked, by the difference in the length of the hairs, from the area occupied by the iridescent wing-pattern. In some forms of this species the hairs are much elongated, as in *O. speculum*, just within the margin of the large middle-lobe. At the base of the labellum beneath the rostellum, there is a shallow cup-like depression with a broad opening. The anterior margin and wall of this depression are densely covered with short glandular hairs and the opening is sufficiently large to admit the posterior part of the abdomen of an insect that effects pollination, while the rostellum is sufficiently close to the opening to touch the posterior segments of the insect's body and to affix the pollinia in preparation for transportation to another flower.

Between *O. fusca* and *O. lutea* the differences are chiefly those to be found in the color of the labellum, the fundamental structures of the two species being very similar.

3. ANDRENA NIGROAENEA *Kirby*
A male, three times natural size.

4. ANDRENA TRIMMERANA *Kirby*
A male, about three times natural size.



5. OPHRYS FUSCA *Link.*
A flower, three times natural size.

The Australian orchid *Cryptostylis leptochila*, F.v.M. (1, 6, 9), cross-fertilised by the male Ichneumonid *Lissopimpla semipunctata*, Kirby, with which it attempts to pair (3), carrying off the pollinia (4, 5) on the end of its abdomen (2). Genitalia of male (11, 12, 13). Pollen (8); section of labellum (10); antennal segments (7).

Reproduced from a plate in the Transactions of the Entomological Society of London, 76, pt. 2, (1929) t. 24.

Drawings by Tarlton Rayment.

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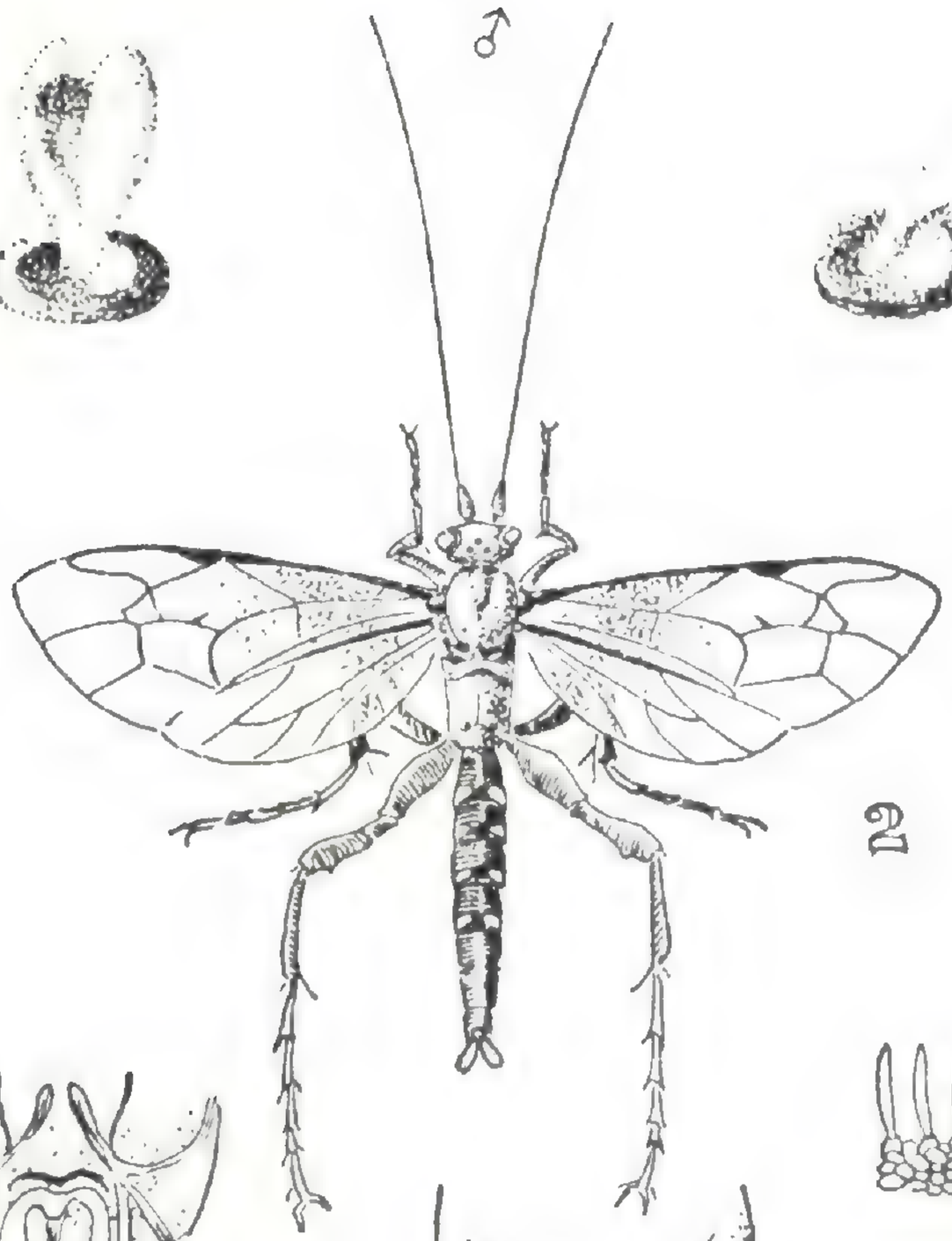
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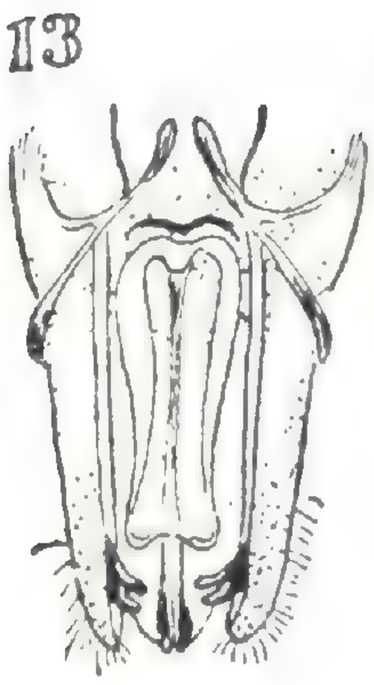
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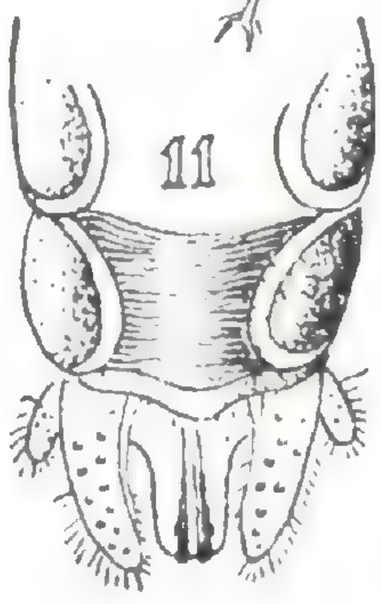
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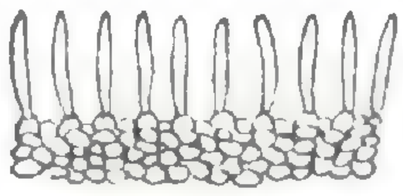
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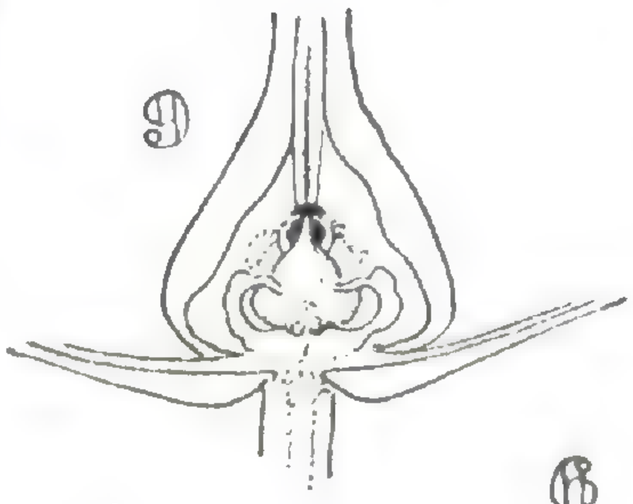
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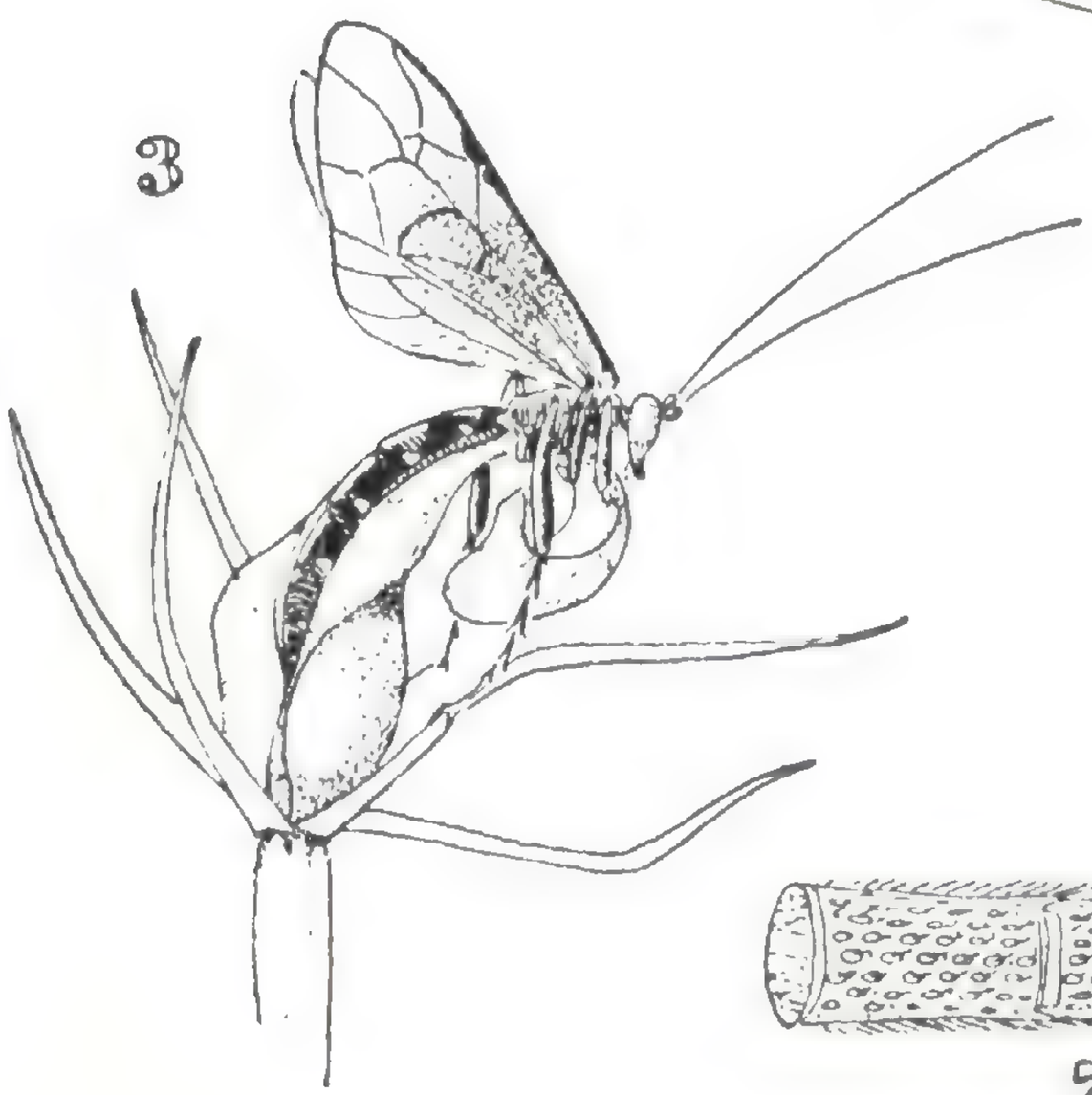
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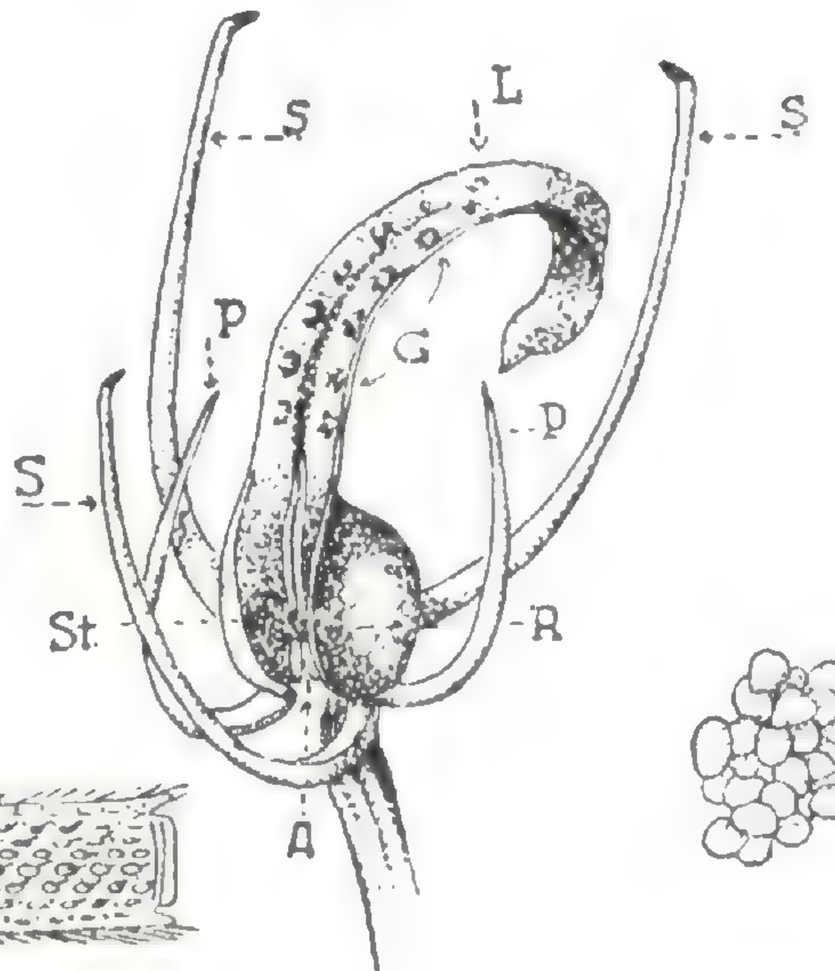
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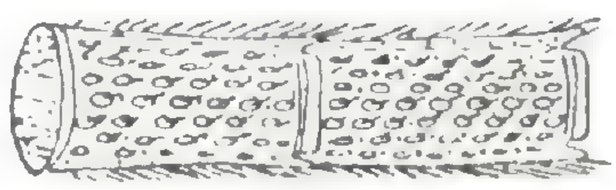
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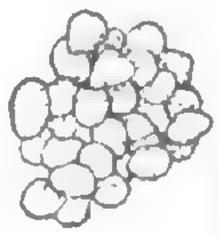
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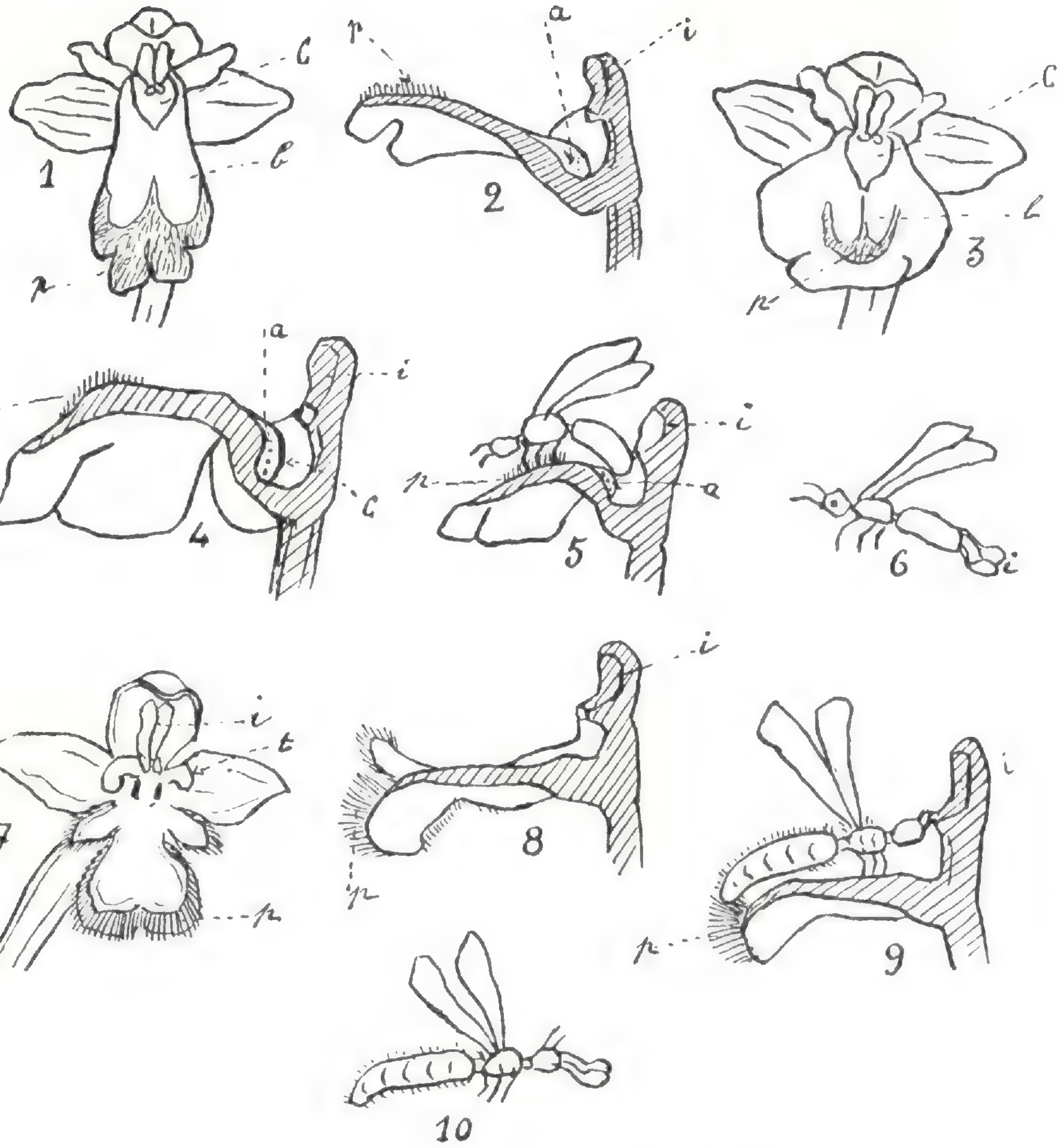

Fécondation des *Ophrys fusca, lutea et speculum.*

1, *Ophrys fusca*, fleur vue de face ; 2, coupe du labelle (grossi). — 3, *O. lutea*, fleur vue de face ; 4, coupe du labelle (grossi) ; 5, fécondation opérée par un petit hyménoptère (coupe du labelle) ; 6, l'hyménoptère s'envole avec les 2 pollinies fixées à l'abdomen. — 7, *O. speculum*, fleur vue de face ; 8, coupe du labelle (grossi) ; 9, fécondation opérée par le mâle du *Colpa aurea* (coupe du labelle) ; 10, le *Colpa* s'envole avec les pollinies fixées sur la tête.

a, petit coussinet garni de poils courts sur lequel frotte l'abdomen de l'insecte ; *b*, tache bleu métallique ; *c*, cavité correspondant à l'éperon des *Orchis*, dans laquelle plonge l'abdomen de l'insecte ; *i*, pollinies ; *p*, pilosité fauve entourant le labelle (poils épais et longs) ; *t*, pétales.

Reproduced from a text-cut in Journ. de la Société Nationale d' Horticulture de France, ser. 4, 17 (1916) 45 (Cf. footnote on p. 4).

Drawings by A. Pouyanne

ORCHID STUDIES. I.

BY

LOUIS O. WILLIAMS

Arachnis longicaulis *(Schltr.) L. O. Williams comb. nov.*

Vandopsis longicaulis Schlechter in Fedde Repert. Beihefte 1 (1914) 973.

Arachnis Lyonii Ames Orch. 5 (1915) 221.

Specimens examined:

PHILIPPINE ISLANDS, Luzon, Province of Rizal. September 1909. *Loher 14583* and *14680*. Growing in rocks; Province of Isabela. Altitude 3000 feet. No date. *Lyon 126*: Mindanao. Camp Keithly, Lake Lanao. September-October 1906. *Clemens s.n.*

NEW GUINEA, Kaiser-Wilhelmsland. Auf Bäumen in den Wäldern am Kenejia. Altitude 150 meters. October 17, 1908. *Schlechter 18420*.

Without doubt the names cited above comprise a single species. There are two sheets of the type number of Schlechter's species in Herb. Ames; on one of these sheets the flowers are much larger than those of any material from the Philippines I have examined; on the other sheet the flowers are equal in size to those borne by Philippine specimens. The details of the flowers seem to be identical.

Renanthera philippinensis *(Ames & Quis.) L. O. Williams comb. nov.*

Renanthera Storiei Reichb. f. var. *philippinensis* Ames & Quisumbing in Philipp. Journ. Sci. 47 (1932) 210, t. 3, figs. 1-2; t. 7, figs. 12-19; t. 24 in part.

There is no doubt but that *Renanthera philippinensis* is quite distinct from *Renanthera Storiei* Reichb. f. Ames and Quisumbing pointed out in the original description of *R. Storiei* var. *philippinensis* that the type of their va-

rietal concept "differs radically from the species in its small stature, small leaves and flowers, and the narrower broadly truncated lateral lobes of the labellum." In addition to the differences emphasized by Ames and Quisumbing there is another difference found in the attachment and in the form of the mid-lobe of the lip. Also the two primary calli on the lip are slightly different from what obtains in *R. Storiei.*

Ames and Quisumbing gave as a reason for assigning this material to varietal rank their belief that a specimen in Herb. Ames *(Loher 6000)* constituted an intergrading form "clearly referable to var. *philippinensis.*" There are in Herb. Ames two sheets of this Loher collection. One sheet bears the terminal portion of the stem accompanied by leaves and an immature inflorescence; the other sheet bears an inflorescence with the flowers fully developed and in size equal to the flowers of *R. Storiei.* Dissections from both sheets reveal the floral structure of *R. Storiei* and differ markedly from *R. philippinensis.*

Sarcochilus Hubbardianus *L. O. Williams nom. nov.*

Thriaspermum philippinense Ames in Philipp. Journ. Sci. 8 (1913) 437.

Sarcochilus philippinensis Ames Orch. 5 (1915) 215—in Merrill Enum. Philipp. Fl. Pl. (1925) 408, non Vidal 1885.

Conformity to the accepted rules of nomenclature necessitate a new name for this rather common Philippine species. It is renamed in honor of Mr. F. Tracy Hubbard who assisted in the bibliographical research undertaken in the preparation of the treatment of the Apostasiaceae and Orchidaceae in Merrill's "An Enumeration of the Philippine flowering Plants."

COLLEGE

BOTANICAL MUSEUM LEAFLETS
HARVARD UNIVERSITY

CAMBRIDGE, MASSACHUSETTS, AUGUST 3, 1937 VOL. 5, NO. 2

A NEW GENUS OF THE SOBRALIEAE

BY
OAKES AMES AND CHARLES SCHWEINFURTH

IN 1936, our attention was called to an extremely puzzling orchid discovered by Walter R. Lindsay in Panama. The general aspect of the plant suggested some species of Sobralia, but the structure of the lip, with two basal calli similar to those found in Elleanthus, and the details of the column indicated differences sufficiently weighty to warrant recognition of a distinct genus of the Sobralieae standing between Sobralia and Elleanthus.

Lindsayella *Ames & Schweinfurth gen. nov.*

Divisio: Acrotonae. Tribus: Polychondreae. Subtribus: Sobralieae. Perianthii partes liberae, basi campanulatae, superne patenti-recurvatae. Sepala similia, elliptico-lanceolata. Petala elliptica, sepalis latiora. Labellum inferne columnam circumdans, superne patens, simplex, apice bilobatum, basi cum callis binis approximatis et superne cum carina singula undulata ornatum. Columna gracilis, apoda, apice dilatata; rostellum trilobatum cum lobo intermedio brevissimo lato emarginato. Anthera incumbens, persistens, bilocularis cum loculis bicellularibus. Pollinia octo, in paribus cum glande rigida connexa.

Herba terrestris vel epiphytica. Folia disticha, pauca, perangusta. Vernatio foliorum duplicativa sed in siccitate

valde nervoso-plicata. Flos saepissime solitarius. Species una adhuc reperta, habitu Sobraliae et Elleanthi.

Lindsayella amabilis *Ames & Schweinfurth sp. nov.*

Herba caespitosa, gracilis, radicibus numerosis fibrosis carnosis. Caules graciles, elongati. Folia disticha, ad vaginas aretas tubulares articulata, perangusta. Flos saepissime singulus, terminalis, pulcherrimus, membranaceus, coccineus. Sepala elliptico-lanceolata, acuta; lateralia paulo obliqua. Petala sepalis latiora. Labellum simplex, ambitu subquadrato-obovatum, parte anteriore paulo latiori, apice bilobatum, prope basim cum callis binis approximatis et superne cum carina humili undulata ornatum. Columna gracilis, apice dilatata. Pollinia octo, in paribus connexa.

Plant caespitose, six to ten stems in a cluster. Roots fibrous, numerous, fleshy, branched. Mature flowering stems up to 37.5 cm. tall, slender, up to 3 mm. in diameter, more or less concealed by the leaf-sheaths, glabrous or sometimes lepidote above. Leaves distichous, three to eight on the upper part of the stem, linear-lanceolate, linear-elliptic or linear, the uppermost and lowermost apparently much smaller, up to 10.5 cm. long and 11 mm. wide, rigid and coriaceous, strongly plicate, gradually narrowed to an obtuse or minutely tridenticulate apex, sessile, articulated to close elongate cylindrical sheaths, about 7-nerved, more or less spreading. Inflorescence terminal. Flower usually solitary (very rarely in pairs), rising from between a pair of narrow erect imbricating conduplicate bracts in the axil of the uppermost reduced leaf, showy, membranaceous, rose-pink, odorless, blooming from about 6 o'clock in the morning until about 7 or 8 o'clock in the evening (ephemeral). Perianth segments free, campanulate at the base, spreading and recurved above. Dorsal sepal elliptic-lanceolate, about 2.7

cm. long when spread out, 7 mm. wide, acute, 9-nerved at the base. Lateral sepals similar, about 2.8 cm. long, 7.6 mm. wide, acute, 9-nerved at the base, slightly oblique. Petals elliptic, about 2.5 cm. long and 11.8 mm. wide, acute, 9-nerved near the base. Lip surrounding the column, subquadrate-obovate in outline, simple, bilobed at the apex with each lobule again bilobed near the centre of the lip, about 3.1 cm. long from the base to the tip of a lobule and about 11.9 mm. wide near the apex; lamina with the margin irregularly crenulate, provided near the base with a pair of closely approximate semiellipsoid calli in front of which is a small transverse fleshy thickening, from near this thickening to near the middle sinus between the lobules there is a slightly elevated undulate white keel. Column slender, abruptly dilated at the apex, about 12.3 mm. long measuring along the anterior grooved surface, irregularly lobulate above; rostellum 3-lobed with the small lateral lobes subquadrate and truncate-retuse and the very short and broad mid-lobe shallowly retuse. Anther persistent, incumbent, 2-celled with each cell 2-chambered. Pollinia apparently eight, each pair connected by a fleshy-granular transverse band.

Lindsayella amabilis superficially resembles a delicate small-flowered Sobralia or Fregea. However, the flowers resemble Elleanthus in having a basal pair of calli on the lip, but differ from the flowers of that genus in being relatively very large occurring singly (rarely two being produced on each stem). In addition to the differentiating characters exhibited by the inflorescence and lip, the structure of the column and the form of the pollinia serve to separate Lindsayella from all of the allied genera.

PANAMA, Province of Chiriqui, El Valle. At 2000 feet altitude. In crevices of rocks or more rarely on a very large dead tree. July 22, 1935. *Walter R. Lindsay and G. H. Bevins s.n.* (TYPE in Herb. Ames No. 45675.)

A NEW EPIDENDRUM FROM MEXICO

BY

OAKES AMES

THE SPECIES OF EPIDENDRUM described below is represented in my herbarium by a single specimen received on July 22, 1937, from Erik Östlund of Cuernavaca, Mexico. The notes accompanying this specimen indicate the existence in Mr. Östlund's garden of two distinct collections: one made in June 1935, in San Luis Potosi northwest of Tamasopo; the other made in the same region in November 1937, near Las Canoas. This is an extraordinarily beautiful Epidendrum and should be in general cultivation because of its horticultural merits. The specific name of this beautiful thing recalls to memory Mrs. Mary L. Östlund, whose deep interest in the orchids of Mexico found expression in her skilful and sympathetic care of the collection at Cuernavaca.

Epidendrum Mariae *Ames sp. nov.*

§ Encyclium. Pseudobulbi caespitosi, anguste pyriformes, diphylli. Folia oblonga, utrinque angustata, apice acuta. Pedunculus elongatus, triflorus. Flores grandes. Sepala lateralia anguste oblonga, acuta, nervosa. Sepalum dorsale simile. Petala lineari-oblonga, acuta. Labellum leviter panduratum, apice bifidum; discus medio callo carinato ornatus. Columna simplex, exauriculata. Pollinia valde complanata.

Pseudobulbs caespitose, slenderly pyriform, about 4 cm. long, 11 mm. in diameter, finely and shallowly rugose, diphyllous at the summit. Leaves about 1 dm. long, up to 2 cm. wide, oblong, acute, olive-green. Peduncle 23 cm. long, with several scarious closely appressed sheathing bracts which are 4.5 cm. apart, each one nigro-annulate at the base. Flowers large for the genus, few

(one to three according to Östlund's notes), 1–3 cm. apart, near the upper end of the peduncle. Lateral sepals about 3.5 cm. long, about 7.5 mm. wide, greenish becoming brownish yellow, rather firm in texture, nervose when dry, narrowly oblong, acute. Dorsal sepal similar. Petals 3.7 cm. long, about 5 mm. wide, linear-oblong, acute, similar to the sepals in texture, greenish yellow. Labellum lightly pandurate, about 5.5 cm. long, 3.3 cm. wide near the deeply bilobed apex with the lobes 1.3 cm. long and 1.5 cm. wide, white with yellow-green nerves in the throat, the texture firm but membranaceous. Disc conspicuously unicarinate for one half its length along the middle with a raised nerve on each side of the keel which is white and much broader at the base than elsewhere, the basal part being strongly concave. Column about 2 cm. long, simple, free from the lip almost to the base, greenish near the base, white above the middle. Pollinia four, strongly complanate.

This remarkable species is in the alliance formed by *Epidendrum Ghiesbreghtianum* A. Rich. & Gal. and *E. hastatum* Lindl. From *E. Ghiesbreghtianum*, with which it is most closely allied, it differs in the structure of the labellum and in the much larger flowers with differently colored sepals and petals. The type possesses three flowers on the elongated peduncle, but in the notes sent to me by Mr. Östlund there is a reference to plants that produce a one-flowered inflorescence. In some of the specimens observed by Mr. Östlund the labellum attained a length of 7.5 cm. and a width of 4.8 cm., so that *E. Mariae* is one of the largest flowered species of the genus.

MEXICO, San Luis Potosi, region of Las Canoas in oak and cypress forest at 1000 meters altitude. November 27, 1935. *Erik Östlund 5103* (Collector O. Nagel). Flowering under cultivation at Colonia del Valle, D. F. June and July 1937. (TYPE in Herb. Ames No. 45825.)

NOMENCLATORIAL NOTES. V.

BY

CHARLES SCHWEINFURTH

Elleanthus Jimenezii *(Schltr.) C. Schweinfurth comb. nov.*

Epilyna Jimenezii Schlechter in Beihefte Bot. Centralbl. 36, Abt. 2 (1918) 375.

There appears to be no doubt that the monotypic species furnishing the concept *Epilyna* Schltr. is referable to the genus *Elleanthus*. Its flowers, with the exception of an abbreviated column, are entirely typical of *Elleanthus*. The small size of all parts and the general aspect are mostly matched by *Elleanthus muscicola* Schltr., except that in *Epilyna* the floral bracts also are abbreviated.

The divergence of *Epilyna* from *Elleanthus* is wholly vegetative, the only striking difference from *Elleanthus* and from all the other members of the Sobralieae is that the leaves of *Epilyna* are not articulated to the leaf-sheaths. This difference, however, is scarcely deserving of generic recognition, particularly in view of the fact that exarticulate leaves occur in the genus *Epidendrum* in which the leaves are almost uniformly articulated to the leaf-sheaths.

To be sure, the general aspect of this concept is suggestive of certain members of the genus Epidendrum of the *E. Endresii* Reichb.f. alliance, but the flowers show that Kränzlin's contention (in Vierteljahrsschrift Naturforsch. Gesell. Zürich 74 (1929) 138) that it belongs to that genus cannot be entertained.

As the original diagnosis of *Epilyna* states, the name is compounded from its supposed allies—*Epidendrum* and *Evelyna*, a younger name for *Elleanthus*.

Epipactis magnibracteata *C. Schweinfurth nom. nov.*

Amesia longibracteata C. Schweinfurth in Journ. Arn. Arb. 10 (1929) 172.

Since the generic name *Amesia* A. Nels. & Macbr. was recently rejected by the International Botanical Congress of 1930 in favor of the conserved *Epipactis* Zinn, the transfer of *Amesia longibracteata* becomes necessary. The combination *Epipactis longibracteata* appears to have been used by Wettstein in 1889, and accordingly the new specific epithet magnibracteata is proposed.

Maxillaria ctenostachya *Reichenbach filius* in Gard. Chron. (1870) 39.

Maxillaria ctenostachys Reichenbach filius ex Schlechter in Beihefte Bot. Centralbl. 36, Abt. 2 (1918) 495.
Camaridium arachnites Schlechter in Fedde Repert. Beihefte 17 (1922) 73.
Camaridium ctenostachys Schlechter in Fedde Repert. Beihefte 19 (1923) 238.

A comparison of *Camaridium arachnites*, as represented by an analytical drawing of the type made under the supervision of Dr. Schlechter, and a collection bearing the type number show that it is conspecific with *Maxillaria ctenostachya* as exemplified by a record of the type from the Reichenbachian Herbarium.

In *Camaridium arachnites* the floral bract about twice surpasses the ovary, the flowers are described as white and the callus of the lip is shown as consisting of a simple depressed apically dilated thickening. In *Maxillaria ctenostachya*, on the other hand, the floral bract is described as subequaling the ovary (but drawn as often much exceeding the ovary), the flowers are said to be ochre-colored and the callus consists of five approximate inconspicuous keels of which the three central ones con-

verge into a conspicuous fleshy thickening. On careful examination of the type number of *Camaridium arachnites*, however, the central callus is seen to consist of five approximate keels of which the three central ones are confluent into a fleshy apex, as in *Maxillaria ctenostachya*.

A RARE EPIDENDRUM FROM MEXICO

BY

OAKES AMES

Epidendrum Karwinskii *Reichenbach filius* in Bonpl. 4 (1856) 327.

Isochilus cernuum Lindley in Ann. & Mag. Nat. Hist. ser. 1, 10 (1842) 184, non *Epidendrum cernuum* HBK.

Among specimens recently received from the Royal Botanic Gardens, Kew, the exceptionally rare and little-known *Epidendrum Karwinskii* Reichb.f. has been recognized. As this species has been known only from the type, the following record is noteworthy.

MEXICO, State of Mexico, Temascaltepec, Cuentla. At 1960 meters altitude. April 1933. *G. B. Hinton 3697*.

HARVARD COLLEGE
OCT 20 1937

BOTANICAL MUSEUM LEAFLETS
HARVARD UNIVERSITY

CAMBRIDGE, MASSACHUSETTS, OCTOBER 19, 1937 VOL. 5, NO. 3

ORCHID STUDIES, II

BY
LOUIS O. WILLIAMS

THE FOLLOWING SPECIES of *Dendrobium* have been found in a collection of about two hundred specimens awaiting determination. These species were collected in the Philippine Islands.

The subgenera outlined by Kränzlin in his monograph of *Dendrobium* are used here in preference to the more complicated system proposed by Schlechter in his "Die Orchideen von Deutsch-Neu-Guinea." The latter system was followed by Ames in his first comprehensive account of the Philippine Orchidaceae (Orchidaceae 5 (1915) 106-113). One of the species described below, which would belong to the genus *Desmotrichum* if Kränzlin's treatment were followed, is referred to *Dendrobium*.

Dendrobium (Subg. Grastidium § Conostalix) **nemorale** *L. O. Williams, n. sp.*

Herba epiphytica, caulibus usque ad 3 dm. longis; caules pluriarticulati, incrassati; folia lanceolata, acuta, apice inconspicue bilobata, subtus sparse nigro-pubescentia; inflorescentia brevis, uni- vel biflora; sepalum dorsale lanceolatum, acutum; sepala lateralia similia; petala late lanceolata, acuta vel obtusa, paulo obliqua et raro obscure denticulata; labellum trilobatum, lobi laterales prominentes, paulo divergentes, obtusi, lobo medio transverse ovali; columna generis.

An epiphytic herb with stems up to 3 dm. long. Stems multiarticulate, thickened, the segments 0.5–2.5 cm. long, decreasing in length upward, the old leaf-sheaths remaining for a long time; leaves lanceolate, acute, thin, 3–5-nerved, unequally bilobed at the apex, glabrous above, glabrous or sparingly black-pubescent below, 25–45 mm. long, 5–9 mm. broad, articulated to the striated black-pubescent sheaths which become glabrous with age; inflorescence short, probably only 1- or 2-flowered; flowers about 15 mm. long, probably white or ivory-colored; dorsal sepal lanceolate, acute, about 10 mm. long and 4 mm. broad; lateral sepals attached mainly to the column-foot, blade about 10 mm. long and 4 mm. broad, —forming a short serotiform mentum at the base which is about 4 mm. long; petals broadly oblanceolate, obtuse or acute, slightly oblique and often obscurely denticulate, about 10 mm. long and 4 mm. broad near the apex; lip 3-lobed, about 12 mm. long and 10 mm. broad from the tips of the lateral lobes,—lateral lobes prominent, slightly divergent, obtuse, about 8 mm. long, —middle lobe transversely oval, about 4 mm. long and 10 mm. broad; column about 3 mm. long, the stelidia erect, about 1 mm. long.

Luzon: Montalban, Province of Rizal, April 1912, *Loher s.n.* (Type in Herb. Ames No. 44750).

Dendrobium nemorale is not closely allied to any of the other species of the subgenus or section known to me.

Dendrobium (Subg. Pedilonum) **crassimarginatum** *L. O. Williams, n. sp.*

Herba epiphytica caulibus usque ad 3 dm. longis. Folia lanceolata, acuta, cum quinque nervis; inflorescentia plerumque biflora, prope caulis medium; flores parvi, albi; sepalum dorsale lanceolatum, acutum; se-

pala lateralia lanceolata, obtusa vel acuta, paulo obliqua; petala elliptica, acuta vel obtusa; labellum simplex, ellipticum, basi unguiculatum, margine incrassato: columna generis.

An epiphytic herb with simple or branched stems up to 3 dm. long. Stems multiarticulate, indurated but not greatly thickened, the segments mostly 1–1.5 cm. long, the older ones with the shredded remains of the old leaf-sheaths, yellow in color, the younger parts of the stem covered with the loose leaf-sheaths: leaves lanceolate, acute, mostly with five main nerves, 3–4 cm. long, 7–9 mm. broad (as far as known), articulated to the striated sheaths: inflorescence usually 2-flowered, borne at or near the end of the stem: flowers rather small, white, about 1.5 cm. long: dorsal sepal lanceolate, acute, 5-nerved, joined with the lateral sepals for a short distance at the base, about 10 mm. long and 4 mm. broad: lateral sepals attached to the column-foot, lanceolate, obtuse or acutish, slightly oblique, 5-nerved, blade about 10 mm. long and 4 mm. broad, prolonged into a mentum which is closed for only about 3 mm., the mentum (and column-foot) about 6 mm. long: petals elliptic, acute or obtuse, 3-nerved, about 10 mm. long and 4.5 mm. broad: lip simple, elliptic, attenuated into a claw at the base, the lateral margins of the blade thickened and toothed or scalloped, about 14 mm. long including the claw and about 6 mm. broad; column short, about 2 mm. long, stelidia erect, lanceolate.

LEYTE: epiphyte in forest, Jaro, Masaganap, flowers white, alt. 600 m., Nov. 23, 1914, *Wenzel 706*; epiphyte in forest, Jaro, Conpagal, flowers white, alt. 800 m., Nov. 25, 1914, *Wenzel 748* (TYPE in Herb. Ames No. 44697).

I have been unable to discover close allies for this species, either in the Philippines or elsewhere. The pe-

culiar thickening on the margins of the lip makes it easily recognizable.

The bi-flowered inflorescence might cause it to be confused with species of the Subg. Grastidium. All of the other characters however, would indicate that it belongs to the Subg. Pedilonum.

Dendrobium (Subg. Pedilonum) **diffusum** *L. O. Williams, n. sp.*

Herba epiphytica cum caulibus pluribus basilaribus. Caules ramosi, multiarticulati: folia lanceolata, acuta: inflorescentia 1-2-flora: sepalum dorsale lanceolatum, acutum: sepala lateralia similia: petala oblanceolata, acuta: labellum trilobatum, anguste rhombicum, lobis lateralibus parvis, lobo medio lanceolato.

A much branched epiphytic herb with a number of stems from a common base. Stems multiarticulate and branched, indurated but not greatly thickened, the segments 1–2.5 cm. long, the older ones often with the shredded remains of the old leaf-bases, yellow in color, the younger parts of the stem covered with the leaf-sheaths, not greatly thickened: leaves lanceolate, acute, thin, several-nerved, 2.5–6 cm. long, 3–7 mm. broad, articulated to the striated sheaths which invest the stem: inflorescence of but one or two flowers: bracts hyaline, lanceolate, about 2 mm. long; flowers medium-sized, about 15 mm. long including the mentum; dorsal sepal lanceolate, acute, 5-nerved, about 12 mm. long and 5 mm. broad: lateral sepals attached to the column-foot and with it forming a curved mentum which is 6–7 mm. long, free part of the blade lanceolate, acute, about 12 mm. long and 4–5 mm. broad; petals oblanceolate, acute, about 12 mm. long and 3–4 mm. broad; lip 3-lobed, narrowly rhombic in outline, about 18 mm. long and 8 mm. broad,—the lateral lobes small, near the middle of the

lip which is the broadest part,—margin of the lanceolate middle lobe often irregularly cut; column short, about 2 mm. long, stelidia erect.

MINDANAO: Todaya (Mt. Apo), District of Davao, August 1909, *Elmer 11502* (TYPE in Herb. Ames No. 44950).

The following field note, made by Mr. Elmer, accompanies the specimen:

"Small tufts upon limbs of trees on a very steep edge of the Cati Creek at 5750 feet of Mt. Apo. Stems quite rigid, descending, green and covered more or less with grayish marcescent sheaths, branched; leaves descending, flat, thickly coriaceous, the apex recurved, paler green beneath; flowers creamy white, pendulous, upon the leafless stalks.—Saromat-ta-cayo."

This species is rather an outstanding one. It seems to have no near allies either in the Philippines or elsewhere.

Dendrobium (Subg. Pedilonum) **serratilabium** *L. O. Williams, n. sp.*

Herba epiphytica cum caulibus usque ad 4 dm. longis. Caules multiarticulati, incrassati; folia lanceolata, acuta vel acuminata: inflorescentia brevis, pauciflora; sepalum dorsale late lanceolatum, acutum; sepala lateralia similia, mentum formantia; petala elliptico-lanceolata, acuta; labellum basi unguiculatum, lamina rotundata vel late subcordata, serrata vel lacerata; columna generis.

An epiphytic herb with stems up to 4 dm. long. Stems multiarticulate, thickened, much wrinkled (at least in dry material) the segments mostly 1.5–2 cm. long, the older ones often with the remains of the old leaf-sheaths, yellow in color, the younger (annual) part of the stem not much thickened and covered with the leaf-sheaths; leaves lanceolate, acute or acuminate, with about seven

prominent nerves, those known 6–8 cm. long and 1–1.5 cm. broad, articulated to the striated sheaths which loosely invest the stems; inflorescence short, apparently few-flowered and borne on the older (leafless?) part of the stem at an articulation; bracts lanceolate, acute, about 4–5 mm. long; flowers fairly large, probably white, including the mentum about 3.5 cm. long; dorsal sepal broadly lanceolate, acute, 7-nerved, joined at the base with the lateral sepals for about 1.5 mm., about 17 mm. long and 7 mm. broad; lateral sepals attached to the column-foot, free part of the blade broadly lanceolate, acute, 7-nerved, about 16 mm. long and 7 mm. broad, prolonged into a long mentum at the base which is closed almost to the column, mentum straight, slender, about 25 mm. long and 4 mm. broad near the middle; petals elliptic-lanceolate, acute, 5-nerved, about 16 mm. long and 7 mm. broad; lip long-clawed, the claw extending almost to the tip of the mentum, free portion of the claw linear, with a small recurved median callus near the base and two very small lateral lobes or teeth near the expanded portion of the lip, about 20 mm. long and 2 mm. broad, expanded part of the lip rotund or broadly subcordate, the lateral margins cut with linear or lanceolate irregular teeth, about 10–12 mm. long and 14 mm. broad; column short, about 2 mm. long, stelidia erect, the lateral ones ovate, about 2 mm. long, the median one narrowly triangular, about 1 mm. long.

Luzon: Province of Rizal, Sept. 1909, *Loher s.n.*; Province of Rizal, Sept. 1909, *Loher 14709* (Type in Herb. Ames No. 44653); Province of Rizal, Sept. 1909, *Loher 14726 in part.*

In addition to the above specimens there is an unidentified slide in the glycerine collection in Herb. Ames which probably belongs to this species. It is *Elmer 17125* from Luzon but the corresponding specimen has not been located.

This species which has no very close allies among the Philippine Dendrobiums is easily distinguished by means of the broad, serrated blade of the lip. The species to which it seems most closely allied is *Dendrobium Lawesii* F.v.Müller of New Guinea.

Dendrobium (Subg. Dendrocoryne) **platycaulon** *Rolfe* in Kew Bull. (1892) 139.

This rare species, which has not been previously known from wild specimens, is now represented in Herb. Ames by the following specimens:

Luzon: Province of Rizal, Sept. 1909, *Loher 14586*.
Mindanao: Lake Mainit, Province of Surigao, June 1909, *Loher s.n.*

Two other specimens which are not in condition for positive determination probably belong to this species.

Bohol: in damp forest or tree trunk, Bilar, alt. 2000 ft., Oct. 9, 1923, *Ramos 3118*.
Mindanao: on tree trunk, Mt. Tubuan, Zamboanga District, alt. 1200 ft., *Ramos & Edaño 36619*.

Dendrobium (Subg. Bolbodium) **microphyton** *L. O. Williams, n. sp.*

Herba epiphytica parva, repens, caulibus usque ad 10 cm. longis. Folia lanceolata vel elliptica, obtusa, apice obscure bilobata; inflorescentia uniflora; sepalum dorsale ovato-lanceolatum, acutum; sepala lateralia late ovata; petala lineari-oblonga, acuta; labellum oblongum, trilobatum, lobi laterales parvi, lobo medio bilobato et paulo incrassato; columna generis.

A small repent epiphytic or terrestrial herb with stems up to 10 cm. long or possibly longer. Pseudobulbs fusiform or ovoid, densely aggregated on the repent stem, 5–10 mm. long and 2–3 mm. thick; leaf one from the summit of each pseudobulb, lanceolate to elliptic,

obtuse, inconspicuously bilobed, narrowed to the base, coriaceous, 10–20 mm. long, 3–5 mm. broad; inflorescence 1-flowered, from the top or near the top of the pseudobulb, consisting of a flower a short pedicel and a bract which surrounds the pedicel; flowers small, white, 5–6 mm. long; dorsal sepal ovate-lanceolate, acute, 3-nerved, about 2.5 mm. long and 2 mm. broad; lateral sepals attached to the column-foot, extended into a short mentum at the base, blade broadly ovate, about 3 mm. long and 2.5 mm. broad; petals linear-oblong, acutish, 1-nerved, about 3 mm. long and 0.7–0.8 mm. broad; lip oblong in outline, 3-lobed, about 4.5 mm. long and 2 mm. broad, the lateral lobes small, very thin and inconspicuous,—the middle lobe bilobed and thickened; column, including the three erect stelidia, about 2 mm. long; column-foot finely crisped-pilose-pubescent near the column.

Bohol: on the top of dry hill in forest, Demyao (Dimiao?), alt. 1000 ft., Sept. 20, 1923, *Ramos 14165* (Type in Herb. Ames No. 44725).

Dendrobium microphyton is a most distinct species with no close allies among the Philippine species of *Dendrobium*. It is apparently closely allied to *Dendrobium funiforme* Blume, a rare species known, according to published records, only from New Guinea. *Dendrobium funiforme* is known to me only from the descriptions and from Blume's figures (Rumphia 4 (1848) t. 193, 4, t.1. 1981). The present species differs from *D. funiforme* in having a 3-lobed oblong lip, not an entire lanceolate one: it also seems to have a shorter mentum. Other differences in the petals and sepals are noticeable, as well as minor differences in the vegetative structure.

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BOTANICAL MUSEUM LEAFLETS
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ORCHID STUDIES, III

BY
LOUIS O. WILLIAMS

ADDITIONS TO THE GENUS *Dendrochilum* BLUME IN THE PHILIPPINE ISLANDS

Dendrochilum (Subg. Platyclinis) **cucullatum** *(Ames) Pfitzer* in Engl., Pflanzenr. IV. 50. II. B. 7. (1907) 98, *fig. 38 J;* Ames, Orch. 2 (1908) 12, 115, *t. 24, fig. III, 3;* Ames, Orch. 5 (1915) 56; Ames in Merrill, Enum. Philipp. Fl. Pl. 1 (1924) 293.

Acoridium cucullatum Ames in Proc. Biol. Soc. Wash. 19 (1906) 153.

Dendrochilum cucullatum had not appeared in collections, until recently, since Copeland's original collection in 1904. Through the kindness of Dr. Eduardo Quisumbing, of the Bureau of Science, Manila, several excellent specimens of this plant have been received for determination.

MINDANAO: Mt. Matutum, Cotabato Province, April 1932, *Ramos & Edaño* Bur. Sci. Nos. *85428*, *85431*, *85444*, *85459* and *85466* (Specimens in Herb. Ames and in Herb. Bur. Sci., Manila).

Dendrochilum (Subg. Platyclinis) **filiforme** *Lindl.* var. **Ramosii** *(Ames) L. O. Williams, comb. nov.*

Dendrochilum Ramosii Ames in Philipp. Journ. Sci. 8 (1913) Bot. 410.

A recent study of additional material of *D. Ramosii* indicates that it is only varietally distinct from *D. filiforme* Lindl.

Dendrochilum (Subg. Platyclinis) **rotundilabium** *L. O. Williams, n. sp.*

Herba epiphytica, usque ad 1 dm. alta. Pseudobulbi ovoidei vel fusiformes, sulcati, aggregati. Folia elliptica, acuta, 5–7-nervia. Bracteae inflorescentiae rotundato-ovatae, multinerviae. Sepalum dorsale oblongo-ellipticum, obtusum, uninervium. Sepala lateralia anguste ovata, acuta, uninervia. Petala oblongo-elliptica ad oblongo-lanceolata, obtusa vel acuta, uninervia. Labellum integrum vel margine paulo serrulatum, rotundum, ecallosum, basi paulo saccatum. Columna subgeneris.

An epiphytic herb up to about 1 dm. tall. Pseudobulbs ovoid or fusiform, sulcate (when dry), aggregated, covered with fibrous sheaths, 6–8 mm. long, 3–4 mm. thick when dry. Leaves elliptic, acute, 4–10 cm. long, 5–13 mm. broad; the blade with 5–7 prominent lateral veins, the outer pair on the margin of the blade giving a marginate appearance. Flowering peduncle slender, 6–9 cm. long; the distichous raceme dense, few-flowered, 1.5–2 cm. long, the alternate flowers mostly 1–1.5 mm. apart. Bracts of the inflorescence rotund-ovate, many-nerved, about 2.5–3 mm. long and about as broad, exceeding the pedicel and ovary in length. Dorsal sepal oblong-elliptic, obtuse, 1-nerved, about 3 mm. long and 1.5 mm. broad. Lateral sepals narrowly ovate, acute, 1-nerved, 2.5–3 mm. long and 1.2–1.8 mm. broad. Petals oblong-elliptical to oblong-lanceolate, obtuse or acute, 1-nerved, 2.5–3 mm. long, 1–1.2 mm. broad. Lip entire, the margin sometimes minutely serrulate, rotund, ecallose, slightly saccate at the base, usually 3-nerved, about 2.5 mm. long and as broad. Column only slightly

or not at all arcuate, about 1.5 mm. long; rostellum ovate, thin; clinandrium truncate, slightly denticulate.

Luzon: summit of Mt. Botianay, Camarines Sur, alt. 3000 ft., Nov. 2, 1928, *Edaño 75798* (in Herb. Bur. Sci., Manila); in forest, summit of Mt. Madooy, alt. 2000 ft., Nov. 9, 1928, *Edaño 78814* (Type in Herb. Ames No. 43824); in forest, summit of Mt. Madooy, alt. 2000 ft., Nov. 10, 1928, *Edaño 75832*.

As the genus is now delimited, *Dendrochilum rotundilabium* is one of the smallest, if not the smallest, species in the Philippines and has no near allies. It is easily distinguished from all other species by the small size of the plant, the orbicular lip and the position of the stelidia on the column.

Dendrochilum (Subg. Platyclinis) **serratum** *L. O. Williams, nom. nov.*

Dendrochilum grandiflorum Schltr. in Fedde Repert. Sp. Nov. 8 (1910) 563, non J.J.Sm. 1904.

The origin of this species has been obscure since its publication. Schlechter received the plant under an incorrect name and with incorrect data. He suggested that it might be a native of the Philippine Islands. This suggestion has proved to be correct. The following collections may be referred to this species.

Luzon: Batingtingan, Rizal Province, April 1915, *Loher 12981*; Rizal Province, Sept. 1909, *Loher 14571*; Mt. Lumutan, Province of Rizal, April 1923, *Ramos 42324 & 42325*.

Negros: Dumaguete, Cuernos Mts., Prov. Negros Oriental, April 1908, *Elmer 9909*.

Unlocalized: "Philippinen? Von Sander importiert, wahrscheinlich von Micholitz eingesandt." (Fragment of type and analytical drawings prepared by Schlechter).

Dendrochilum (Subg. Platyclinis) **unicallosum** *L. O. Williams, n. sp.*

Herba epiphytica, usque ad 2.5 dm. alta. Pseudobulbi fusiformes, sulcati, aggregati. Folia elliptico-lanceolata, obtusa vel acuta. Inflorescentia multiflora, bracteae orbiculares. Sepalum dorsale anguste elliptico-lanceolatum, acutum, trinervium. Sepala lateralia late lanceolata, acuta, trinervia. Petala oblanceolata, acuta vel obtusa, paulo denticulata, trinervia. Labellum trilobatum; lobi laterales semiarcuati; lobus medius lanceolatus. Columma generis.

Pseudobulbs sulcate, fusiform, aggregated, covered or sheathed with fibrous maculate sheaths, 2.2–4 cm. long, 0.2–0.6 cm. thick when dry. Leaves elliptic-lanceolate, obtuse or acute, usually constricted near the apex, the blades often with one or two pairs of prominent lateral nerves but none marginate, 6–10 cm. long, 1–2 cm. broad. Pedunele slender, 15–25 cm. long. The distichous multiflorous raceme up to 15 cm. long, rather dense, the alternate flowers about 2 mm. apart. Bracts orbicular, about as long as or usually a little exceeding the ovary in length, 1.5–2 mm. long and as broad. Dorsal sepal narrowly elliptic-lanceolate, acute, 3-nerved, about 3.8 mm. long and 0.8 mm. broad. Lateral sepals broadly lanceolate, acute, 3-nerved, 3–3.2 mm. long, 1–1.3 mm. broad. Petals oblanceolate, acute or obtuse, slightly denticulate, 3-nerved, 2.6–3.1 mm. long, about 1 mm. broad. Lip 3-lobed, about 2 mm. long and 1.7 mm. broad; the lateral lobes semiarcuate, usually obtuse, about 1 mm. long; middle lobe lanceolate, about 1 mm. long from the sinus of the lateral lobes,—with a large callus at the junction of the lip with the foot of the column and two carinae extending from the large callus to about opposite the sinuses of the lobes. Column of the subgenus, short, about 1.3 mm. long; the stelidia arising about opposite the stigma, semiovate; rostellum rather large, ligulate; clinandrium 3-dentate at the apex.

Luzon: Montalban, Prov. Rizal, May 1909, *Loher 12566*; Prov. Rizal, Sept. 1909, *Loher 14643* (Type in Herb. Ames No. 43749): on trees, mossy forest slopes, Mt. Irid, Prov. Rizal, Nov. 1926, *Ramos & Edaño 48450*.

This species resembles *Dendrochilum longispicatum* quite closely in aspect. The structure of the lip is different from that of every other species known to the author; and this difference, together with other characters, serves to distinguish it from its closest allies.

Dendrochilum (Subg. Platyclinis) **yuccaefolium** *L. O. Williams, n. sp.*

Herba epiphytica, usque ad 35 cm. alta. Pseudobulbi anguste cylindracei, sulcati, aggregati. Folia linearia, acuta. Bracteae inflorescentiae oblongo-ovatae, acutae. Sepalum dorsale lineare, acutum. Sepala lateralia linearia, acuta. Petala linearia, integra, trinervia. Labellum oblongo-ovatum, integrum, denticulatum et raro cum lobis lateralibus parvis. Columna subgeneris.

Pseudobulbs narrowly cylindric, sulcate, tapering from the base to the apex, 4.5–5.5 cm. long, 5–10 mm. thick toward the base when dry; flowering pseudobulbs very much smaller and inconspicuous, covered with fibrous sheaths. Leaves linear, acute, tapering gradually to the petiole, margins inrolled, 17–30 cm. long, 9–13 mm. broad; leaves from the flowering pseudobulbs inconspicuous at the time of the flowering. Peduncles 10–17 cm. long, part above the sheaths floriferous. Raceme distichous, rather dense, the alternate flowers about 2.5 mm. apart. Bracts oblong-ovate, acute, strongly striated, about 5 mm. long and 2.5 mm. broad. Dorsal sepal linear, acute, 6.5–7 mm. long, 1–1.5 mm. broad. Lateral sepals linear, acute, 3-nerved, 6.5–7 mm. long, 1–1.5 mm. broad. Petals linear, acute, entire, 3-nerved, 5–6 mm. long, 0.8–1 mm. broad. Lip entire, denticulate or rarely with small

lateral lobes, oblong or oblong-ovate; with three longitudinal carinae, the lateral pair strongly raised. Column arcuate, winged to the apex, about 1.8 mm. long; the stelidia arising about opposite the stigma: rostellum not thickened, triangular: clinandrium 3-dentate at the apex.

Luzon: Montalban, Prov. Rizal, May 1909, *Loher s.n.* (Herb. Bur. Sci., Manila); Paningtingan, Montalban, without date, *Loher 13216* (Type in Herb. Ames No. 43855); Prov. Rizal, Sept. 1909, *Loher 14717*.

This species has no near allies in the Philippines. The peculiar structure of the leaves and the shape and size of the perianth segments render it an easily distinguished and distinctive species.

Dendrochilum gueaefolium seems to be most nearly allied to *D. simile* Blume, a species not yet known from the Philippine Islands. From this species, our plant may be distinguished by its very different leaves and by the inflorescence, as well as by differences to be found in the flower.

Miscellaneous Orchids

Corybas laceratus *L. O. Williams, n. sp.*

Herba parva, terrestris, unifoliata. Folia ovato-cordata, acuminata, leviter crenulata vel integra. Inflorescentia uniflora. Bracteae anguste lineari-lanceolatae, acuminatae. Sepalum dorsale galeatum, obovato-ellipticum. Sepala lateralia filiformia. Petala filiformia. Labellum trilobatum; lobi laterales leviter lacerati; lobus medius recurvatus, ovatus vel rotundus, apice leviter retuso, margine lacerato. Columna generis.

Small terrestrial herbs, the bulbs unknown. Stems up to 5 cm. tall, bearing a single leaf toward the summit. Leaves ovate-cordate, short-acuminate, somewhat crenulate or entire, thin, 1–2.5 cm. long, 0.7–1.5 cm. broad. Inflorescence 1-flowered. Bracts exceeding the ovary, narrowly linear-lanceolate, acuminate, about 8 mm. long. Dorsal sepal galeate, obovate-elliptic, obtuse, about 15 mm. long and 12 mm. broad. Lateral sepals filiform, about 5 mm. long. Petals filiform, about 14 mm. long. Lip 3-lobed, tubular at the base, the margins coherent; lateral lobes short, directed forward, slightly lacerated, about 3 mm. long and as broad; the middle lobe strongly recurved, oval or round, slightly retuse at the apex, the margins strongly lacerated, about 8 mm. long and nearly as broad. Column short, alate toward the apex.

LUZON: Prov. Rizal, Sept. 1909, *Loher 14673* (TYPE in Herb. Ames No. 44947).

Corybas laceratus is most closely allied to *C. Merrillii*, the only other species known to occur in the Philippines, from which it may be easily distinguished by the 3-lobed lip as well as by the lacerations on the lip.

A collection from Burgos, Ilocos Norte Province, Luzon, July 29, 1918, *Ramos 32880*, may be this species but the flowers are agglutinated and certain determination is not possible.

Aglossorrhyncha *Schltr.*

This genus now may be added to the known genera of Philippine orchids. The specimen on which the record is based bears only one flower, and that one is not complete. The plant is apparently an undescribed species but cannot be described on the basis of the available material.

BOHOL: on the trunk [of a tree] in the forest, Demyao (Dimiao?), flowers yellow, alt. 1000 ft., September 21, 1923, *Ramos s.n.*

Erythrodes Merrillii *Ames*, Orch. 3 (1908) 79, *t. 54*; Ames, Orch. 5 (1915) 29: Ames in Merrill, Enum. Philipp. Fl. Pl. 1 (1924) 273.

Herpysma Merrillii Ames in Philipp. Journ. Sci. 2 (1907) Bot. 313: Schltr., Orchideen (1914) 118: J.J. Smith in Blumea 1 (1934) 213.

This interesting and rare plant is now known by a second collection from the Philippine Islands.

Luzon: Montalban, Prov. Rizal, April 1912, *Loher 13279*.

The generic status of this species has been in question since the time of its publication. Described in 1907 as an *Herpysma* without discussion, it was changed to *Erythrodes* in 1908 by Ames and a good discussion of the species was given, stating reasons for the change. Schlechter referred to it under *Herpysma* in his Orchideen in 1914. In 1934, J.J.Smith had occasion to refer to it in connection with his paper "Artificial Key to the Orchid Genera of the Netherlands Indies, together with those of New Guinea, the Malay Peninsula and the Philippines" and referred the species to *Herpysma*. A short discussion of the status of the genus is given. Among others the following statement occurs, "It is not impossible that the very blunt anther forms a good generic character, as it is very different from the, so far as I know, always acuminate anther of the species of *Erythrodes*." I have not seen specimens of *Herpysma longicaulis* Lindl., the generic type, but if plate 367 in Ann. Roy. Bot. Gard. Calcutta 8 (1898) is correct then the blunt anther shown is very different from the long acuminate one of *Erythrodes Merrillii*. Ames' plate (Orch. 3 (1908) *t. 54*) shows the anther to be acute. The floral details of that plate were drawn from buds and according to new material the anther is longer, when mature, than is shown in the plate.

With due regard to the adnation of the lip with the column and the longitudinal carinae of the lip, characters assigned to the genus *Herpysma*, the present author believes that the plant in question should be referred to *Erythrodes*.

Eulophia graminea *Lindl.*, Gen. & Sp. Orch. (1833) 182.

Eulophia sinensis Miq. in Journ. Bot. Néerl. 1 (1861) 91.

Eulophia ramosa Hayata, Materials Fl. Formosa (1911) 332.

Merrill has given the range of this species (Sunyatsenia 1 (1930) 15) as "Assam to Ceylon, Burma and the Andaman Islands, Malay Peninsula to Singapore, Kwantung and Formosa." To the above range, the Philippines may now be added. The specimen at hand is leafless but according to a note by the collector, "la planta ahora no tiene hojas, solamente tallos florales," it is possible that he knew the plant to be leaf-bearing.

LUZON: San Fernando, Prov. Union, Dec. 15, 1918, *R. Lete 467*.

Sarcochilus Carrii *L. O. Williams, nom. nov.*

Sarcochilus maculatus Carr in Gard. Bull. Str. Settlements 5 (1929) 26, *t. 12, fig. A*, non Benth. ex Pfitz. in Vergl. Morph. Orch. (1882) 15.

It is with pleasure that this orchid is renamed for Mr. Carr, who discovered it. With his untimely death a keen collector and critical observer of the orchid family was lost.

Sarcochilus zamboangensis *Ames*, Sched. Orch. No. 5 (1923) 39.

A second collection of this little known plant extends its range to another island of the Philippine group.

Bohol: on the slope of a hill in the forest, Bilar, alt. 2000 ft., September 13, 1923, flowers yellow, *Ramos 1814*.

Rhynchostylis densiflora *(Lindl.) L. O. Williams, comb. nov.*

Saccolabium densiflorum Lindl. in Wall. Cat. (1832) No. 7311; Lindl., Gen. & Sp. Orch. (1833) 220.

Saccolabium giganteum Lindl., in Wall. Cat. (1832) No. 7306.

Vanda densiflora Lindl. in Lindl.& Paxton, Fl.Gard. 2 (1851) 21, sub t. 42.

Anota densiflora Schltr., Die Orchideen (1914) 587. *fig. 198.*

J.J.Smith (Blumea 1 (1934) 215) has called attention to the fact that *Anota* Schltr. is of dubious generic worth and has pointed out that *Anota violacea* should be referred to the genus *Rhynchostylis*. With this interpretation I am in accord and should also place *Anota densiflora* in *Rhynchostylis*.

Arachnis Imthurnii *(Rolfe) L.O.Williams, comb. nov.*

Stauropsis Imthurnii Rolfe in Bot. Mag. (1917) *8714;* Rolfe in Orch. Rev. 26 (1918) 149, 167.

A study of this species indicates that it should be referred to the genus *Arachnis*. The lateral lobes of the lip are entirely free from the column and the attachment at the base, in specimens which I have seen (probably from the type plant), is not so great as that shown in the above cited plate.

Solomon Islands: large epiphyte of scandent habit, Maruto, Island of Isabel, alt. 285 m., Dec. 28, 1932, *Brass 3396*.

Hort.: Herb. Hort. Bot. Reg. Kew., Oct. 23, 1916. (Probably from type plant).

Sarcanthus utriculosus *(Ames) L.O.Williams, comb. nov.*

Camarotis utriculosa Ames, Orch. 5 (1915) 244.

This species, although referred by Ames to *Camarotis*, seems to be a member of the genus *Sarcanthus*. The rostellum is large but is hardly comparable to the rostellum in *Camarotis*. *Sarcanthus utriculosus* is closely allied to *Sarcanthus Merrillianus* Ames, a species native of Borneo.

The following collection of the species is the first record of the genus on Bohol.

Bohol: on a citrus tree in the town, Batuan River, alt. 1000 ft., Sept. 5, 1922, *Ramos 2006*.

Camarotis Loheri *L. O. Williams, n.sp.*

Herba epiphytica. Folia anguste-oblonga, obtusa, coriacea. Bracteae inflorescentiae leviter carinatae, obtusae, concavae. Sepalum dorsale oblongo-lanceolatum, leviter carinatum et naviculare. Sepala lateralia anguste-oblonga, obtusa, apice paulo obliqua. Petala lanceolata, acuta, paulo arcuata. Labellum trilobatum, apice abrupte conico-saccatum; lobi laterales erecti, elongati, carinati; lobus medius parvus, erectus, triangularis. Columna generis.

An epiphytic herb, the size unknown. Leaves narrowly oblong, obtuse, probably not oblique, coriaceous, about 7 cm. long and 1.5 cm. broad. Peduncle breaking through the leaf-sheath opposite the base of a leaf, exceeding the leaves in length, about 17 cm. long (only one seen), bearing 15–20 flowers. Bracts of the inflorescence somewhat carinate, obtuse, concave, about 2 mm. long. Dorsal sepal oblong-lanceolate, slightly carinate and navicular, about 10 mm. long and 4 mm. broad. Lateral sepals narrowly oblong, obtuse, slightly oblique at the apex, adnate to the column by their adjacent margins for about 2 mm., about 8 mm. long and 2.5–3 mm. broad. Petals lanceolate, acute, slightly arcuate, about 9 mm. long and

3 mm. broad. Lip 3-lobed, abruptly conic-saccate toward the apex, about 9 mm. long and 4.5 mm. deep through the sac; lateral lobes of the lip erect, extending from the base nearly to the apex of the lip, carinate; terminal lobe small, erect, triangular, about 1.5 mm. long; lower inner surface of the claw of the lip callose-thickened from the base up to the posterior wall of the sac; anterior wall of the sac with a retrorse, bifurcate, ligulate callus extending over the opening and nearly closing it; in the base of the sac is a longitudinal partition, extending about half way up, which divides the base of the sac into two parts. Column about 2 mm. long; the rostellum very much elongated and strongly sigmoid, about 8 mm. long.

Luzon: Prov. Rizal, Sept. 1909, *Loher s.n.* (Type in Herb. Ames No. 44387).

Camarotis Loheri is most closely allied to *C. philippinensis* Lindl., from which species it may be distinguished by the long ligulate, bifurcate callus on the anterior wall of the sac, by the less prominent lateral lobes of the lip, by the shape of the lip and the differently shaped conic sac, by the more prominent rostellum, by the partition in the sac and by the smaller size of the flowers as well as by the smaller leaves.

This species is the second *Camarotis* to be found in the Philippines, *Camarotis utriculosa* being a species of *Sarcanthus*.

Camarotis Loheri is named in honor of Mr. August Loher, many years a resident of Manila, to whom we are indebted for many critical specimens of Philippine orchids collected in out-of-the-way places.

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PEYOTE (*LOPHOPHORA WILLIAMSII*) AND PLANTS CONFUSED WITH IT

BY

RICHARD EVANS SCHULTES

A STATE of great confusion exists at the present time in the ethnobotany of peyote. This is due partly to long and close association of peyote (*Lophophora Williamsii* (Lemaire) Coulter) with other plants in religious and therapeutic uses and partly to fragmentary and conflicting records of the use of the narcotic plants of Mexico in the early centuries after Spanish settlement of the country. As a result of this confusion, ethnological and other investigations of the narcotic cactus are greatly hindered by widespread ambiguity in plant names. A clear understanding of the complex of plants associated or confused with *Lophophora Williamsii* is absolutely essential to the further progress of anthropological investigation of the ever-increasing peyote-cult of the United States.[1]

I. Common names of Lophophora Williamsii.[2]

The variety of common names which refer to *Lophophora Williamsii* in the United States and Mexico is so great as to demand thorough consideration of the etymology, use, and significance of each name. Moreover, such treatment may be of value in bringing attention to certain otherwise hidden facts attendant upon the aboriginal

[1] Footnotes will be found on pages 78-80.

use or upon the ethnobotanical relationships of the cactus with other economic plants.

1. *Peyote.*

Lophophora Williamsii is most commonly called *pe-yote*. This is the Spanish form of the ancient Nahuatlan *peyotl*. It is variously spelled: *piote*, *piotl*, *peote*, *pejote*, *peyot*, *pellote*, *pezote*, and *peyori*. In Starr County, Texas, the centre of the peyote trade,[1] the corruption *challote* is used by merchants (3).* The related corruption *chautle* or *chaute* are Mexican and Texan names for the supposed medicinal cactuses, *Ariocarpus fissuratus* (Engelm.) K. Schum. (29) and *A. retusus* Scheidw.[3] (2). *Peyote cimarrón* is used to designate *Ariocarpus fissuratus* (29) and, in Durango, *Astrophytum myriostigma* Lem. (2). This term is also used, in Nayarit, as a name for *Senecio Hartwegii* Benth., a member of the *Compositae*, and, in Sinaloa, to designate *Cranichis? speciosa*[4] LaLlave & Lex. and *Bletia campanulata* LaLlave & Lex., members of the *Orchidaceae* (7).

The term *peyote* is used and understood by Indians and white men both in Mexico and the United States; consequently it has become the commercial term. Each tribe, however, possesses its own vernacular name for the cactus, although several plains tribes have adopted the name *peyote* as a naturalized word.

Several etymologies have been proposed for this word. It has been suggested (33, 20) that *peyote* is derived from the Aztec *pepeyoni*[5] or *pepeyon* ("to excite") or from *peyona-nic* ("to activate" or "to stimulate").

Molina (13) derived *peyote* from the Aztec *peyutl*, which, freely rendered, means something soft, silky, and fluffy, like a cocoon or web.[6] The comparison of the silky tufts of matted hair on the crown of the cactus to cater-

*Numbers in parentheses refer to the Bibliography.

pillar cocoons is assumed by those supporting this etymology. At first, this supposition might not seem improbable. In support of this theory, Safford (22) has called attention to a composite, *Cacalia cordifolia* HBK., *cachane*, which is known and marketed in Jalisco under the name *peyotl* (33). This plant has a soft, tuberous root with an endument of velvety hairs, in appearance much like a cocoon. Hernandez (8) called this plant *Peyotl Xochimilicensis*, specifically emphasizing its febrifugal properties and its "wooly rootlets." The same writer described *Lophophora Williamsii* under the name *Peyotl Zacatensis, seu radice molli et lanuginosa*, calling attention again to medicinal and intoxicating properties as well as to the lanuginous appearance of the plant.

Recent investigation has revealed a score or more of very dissimilar plants all known under the term *peyote*. Most of these plants have no soft parts which could be likened to cocoons. Indeed, several are exceedingly hard. Might Hernandez not have called the two plants *peyote* because of some similarity other than the woolliness of parts of the vegetative body? The Molina etymology does not satisfactorily explain the application of the word *peyote* to the great array of plants known under that name in Mexico.

A more recent etymology has been proposed by B. P. Reko (7). It suggests that *peyote* arose directly from the Aztec *pi-yautli*, in which *pi* is a diminutive term and *yautli* (or the alternative *yolli*) is a collective noun signifying herbs whose action is narcotic.[7] In this broad sense, *peyote* would include many plants having, perhaps, nothing in common in vegetative parts, but all possessing narcotic (or perhaps medicinal) properties. A survey of the many plants called peyote (page 70) indicates that they all agree in having a narcotic or supposed medicinal property. This etymology has been carried further (7), as in

EXPLANATION OF THE ILLUSTRATION

FIGURE I. Entire plant of peyote (*Lophophora Williamsii* (Lem.) Coult.) showing details of the chlorophyll-bearing crown of the plant. Variation in the number and appearance of the ribs has given rise to much confusing taxonomic controversy, but this thirteen-ribbed form is typical of older plants. It is this crown which, when cut from the root and dried, is known as the *mescal button*, two of which are illustrated in figure II. Natural size.

the case of the rubber-producing shrub of this region called *guayule* (*Parthenium argentatum* A. Gray). *Guayule* is resolved into *hua*, a prefix denoting magnitude, and *yolli*, thus suggesting that the name means a large herb with a narcotic smell.[8] With the etymology of Reko, the confusion between the Mexican word *piule* (page 67) and *peyote* has been explained as the result of common etymology.

This derivation, having only recently appeared in a publication in the English language (27), has not received wide attention in America. There is some doubt as to the validity of certain phonetic changes involved in this etymology in the minds of American Uto-Aztecan linguistic experts. However, in view of the apparent confirmation it has received from botanical sources, it would seem a more logical explanation than the Molina etymology, and, as such, deserves further linguistic examination.

The diminutive *peyotillo (peotillo)* signifies similarity in appearance to *Lophophora Williamsii*. Under this name are grouped such succulents as *Dolichothele longimamma* Britton & Rose, *Solisia pectinata* Britton & Rose, and *Pelyciphora aselliformis* Ehrenb. (3).

2. *Mescal.*

A name now almost as universally used as peyote is *mescal (mezcal)*. The dried tops of the cactus are sold under the name *mescal buttons* as well as under the name *peyote buttons*, since, on drying, they shrink to the size and shape of large coat-buttons. They are also, though *never correctly*, called *mescal beans*.

The origin of the term *mescal* is found directly in the Aztec word for *Agave*-brandy—*mexcalli*. As applied to *Lophophora Williamsii*, the origin is probably due to a confusion of peyote with the alcoholic beverage prepared from the juice of *Agave* spp. This confusion, no doubt,

arose as the result of the mistaken idea that peyote-intoxication is similar to that produced by alcohol. The logical inference from such a comparison is that the use of peyote is surrounded by the same social, moral, and physical evils associated with alcohol. I found that, for this reason, the term *mescal*, as applied to peyote, is very often resented by the Indians who use the cactus. Much of the hostility of uninformed persons towards the peyote-cult has been based on this erroneous association of ideas.

It has been stated (23) that the application of this name to peyote is the result of the former use of the *mescal bean* (*Sophora secundiflora* (Orteg.) Lag. ex DC.) among the plains Indians to induce visions and that the beans in turn received the name *mescal* because they were occasionally crushed and added to *Agave*-brandy to render it more intoxicating.[9] Logical as this explanation seems to be, there is no reason for assuming such an indirect application. In Mexico, as well as in the American southwest, *Agave*-brandy is found in use among peyote-eating tribes. The addition of ground peyote to fermented fruit juices is common in Mexico (4, 19). This, with the fact that both peyote and *Agave*-brandy are extraordinary intoxicants, provides ample opportunity for a mistaken comparison of the cactus with the drink.

3. *Minor names.*

The opponents of the peyote-cult have, in the past, conferred many derogatory names upon *Lophophora Williamsii*, most of which are still current in the literature.

Of these, the first was invented by the Spanish priest, Ortego, who called peyote *raíz diabolica*. This survives in the present literature as *diabolic root* and *devil's root*.

Dry whiskey[10] (29) and *white mule*[11] are, like *mescal*, names suggesting similarity to alcohol. *White mule* is a term for illicit liquor.

Various names calling attention to the odd shape of the plant have appeared. Among these may be cited: *dumpling-cactus*, *cactus-pudding*, *turnip-cactus* (20), *biznagas* ("carrot") (14), and *tuna de tierra* ("earth-cactus") (25).

II. Plants confused with Lophophora Williamsii

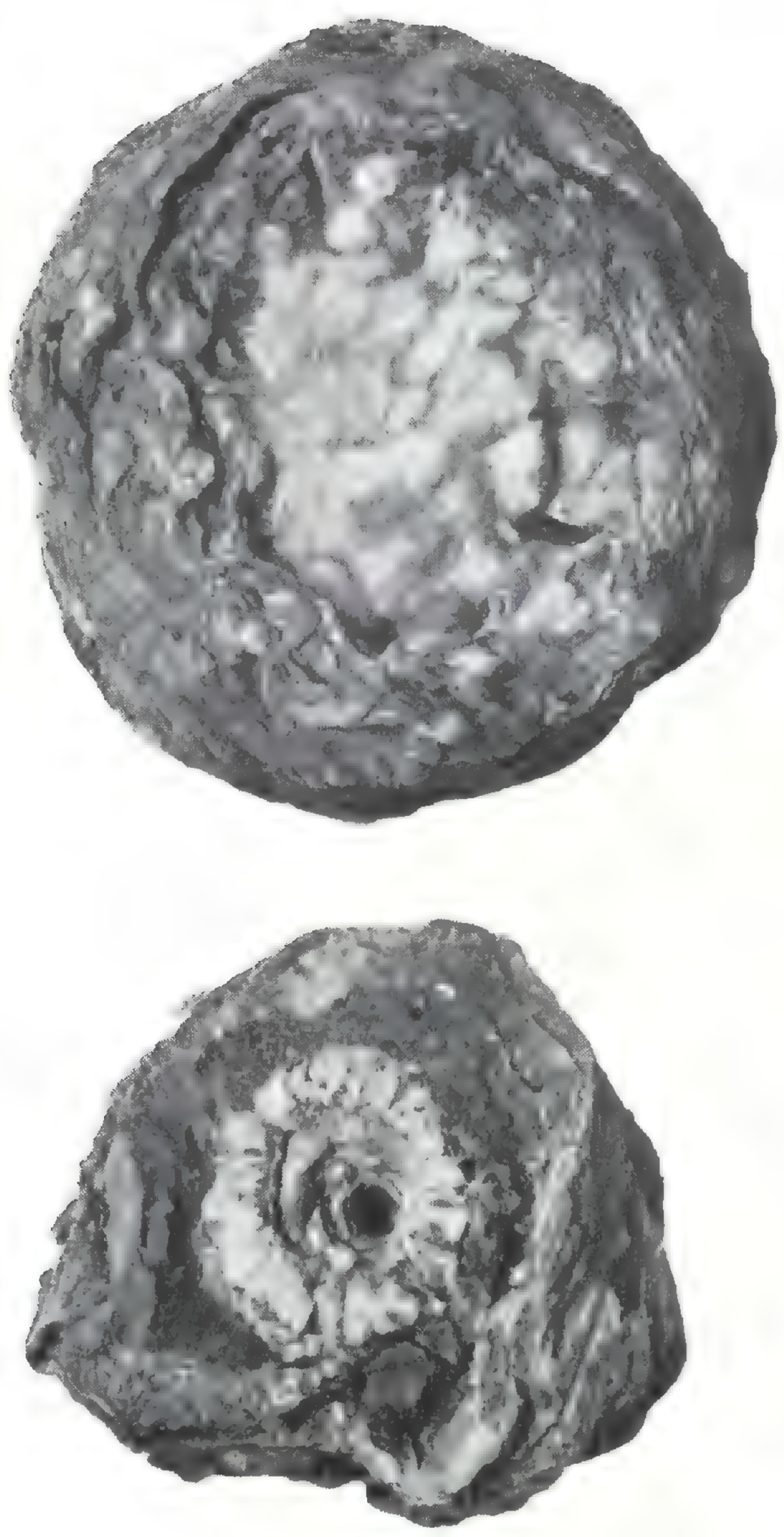
Occasionally, names properly belonging to distinctly different plants are applied to *Lophophora Williamsii* because of an actual or assumed association with it. The name *mescal bean* is an example of this type of confusion.

Recently, the Nahuatlan word *teonanacatl* ("divine flesh") has become a generally accepted name for mescal buttons. This is the direct result of an erroneous identification by Safford (22) of peyote with the sacred, intoxicating mushroom of the Aztecs. Failing to find a fungus possessing narcotic properties in Mexico or the southwestern parts of the United States, and noting that the dried head of *Lophophora Williamsii* resembles "a dried mushroom so remarkably that at first glance it will even deceive a mycologist," Safford concluded that the two were identical.[12] This erroneous identification was readily accepted and has, unfortunately, become firmly established in the literature.

The first record of teonanacatl was made by Sahagun (25). He carefully distinguished between the mushroom and the cactus. In his history, he recorded that the Chichimecas were acquainted with the properties of many plants and had discovered peyote which took the place of wine in their diet. Concerning *nanacatl*, he wrote that they used these mushrooms like wine.[13] In another passage,[14] he described the occurrence of teonanacatl in grassy pastures and certain supposed therapeutic properties which made it a valuable medicine for fevers and rheumatism, but which caused visions, produced nausea, and

EXPLANATION OF THE ILLUSTRATION

FIGURE II. Mescal buttons, the dried crowns of *Lophophora Williamsii*. These are "type" specimens collected in Mexico in 1892 by the explorer, Carl Lumholtz, and sent to the Gray Herbarium. The Mexican Indians who collect peyote string the newly cut crowns on rope and hang them on the backs of mules to dry on the journey home from the peyote fields, hence the central perforation in the lower button. *Above:* View of the top of the dried crown showing the tufts of matted hair still persisting on the areolae. *Below:* View of the base of the crown where it was cut from the root. Natural size. Fruit Room Collection (unnumbered), Gray Herbarium, Harvard University.



were aphrodisiacal. According to Sahagun, the teonanacatl mushroom was small and slender-stemmed.

The fact that *nanacatl* means "mushroom" is well attested. Sahagun (25) used the expression *hongos ó nanacatl* ("mushrooms or nanacatl") in speaking of edible fungi. Hernandez (8) described teonanacatl as *teyhuinti* ("intoxicating") under the caption: *De nanacatl seu Fungorum genere.* He used the word in combinations, such as *iztacnanacame* ("white mushrooms"), *tlapalnanacame* ("red mushrooms"), and *chimalnanacame* ("yellow, orbicular mushrooms").

Further support may be found in several definitions in Siméon's Nahuatlan dictionary (31):

> "*Teyuinti*: qui enivre quelqu'un, enivrant; *teyuinti nanacatl*: champignon enivrant.
>
> "*Teonanacatl*: espèce de petit champignon qui a mauvais goût, enivre, et cause des hallucinations; il est medicinal contre les fièvres et la goutte."

In the writings of de la Serna (30), reference is made to *quauhtlnanacatl* ("wild mushrooms") with properties similar to those of ololiuqui and peyote.

At the present time, the word *nacatl* is widely used in Mexican markets with reference to edible mushrooms in general (19).

The identity of teonanacatl is still unknown. It has been suggested (19) that it is *Amanita mexicana* Murrill, but this has never been corroborated. For several years, however, B. P. Reko has been actively engaged in research concerning the identity of the sacred, intoxicating Aztec mushroom and has recently found a possible solution. His findings have not yet been published.

Lophophora Williamsii is often mistakenly called *ololiuqui* or *piule*. *Ololiuqui* is variously spelled *ololiuhqui*, *ololique*, and *yololique*, a name which, it is suggested (34) is derived from the root *ololoa* meaning "something

round," with reference to the seed of ololiuqui. It is a narcotic Mexican plant, the dried seeds of which, pulverized and soaked in pulque or tepache, produce an intoxicating drink called *piule*. Piule was formerly used as a sorcerer's potion and is still employed as an intoxicant in secluded parts of Mexico, especially in Oaxaca (16).

There has been much dispute concerning the botanical identification of ololiuqui. Mexican authorities (8, 12, 16, 34) hold that it is *Rivea corymbosa* (L.) Hall.f. (*Turbina corymbosa* Raf., *Ipomoea sidaefolia* Choisy). This agrees with the identification of ololiuqui seeds received by the writer from Mexico (27). Urbina (34) reports that other species of *Ipomoea* are also called *ololiuqui*. Several other plants are known under the name *piule*.[15]

Sahagun (25) described two ololiuqui plants. One, apparently a member of the *Solanaceae*, probably *Physalis* sp., was called *zizicamatic*; this was medicinal for indigestion, but had no narcotic properties.[16] The other, *coatl-xoxouhqui* ("green snake"), obviously a member of the *Convolvulaceae*, was medicinal for rheumatism and possessed drastic intoxicating properties when taken as a drink.[17]

Hernandez (8) described and figured ololiuqui or *coatl-huitl* ("snake plant") under the caption *De Ololiuhqui seu planta orbicularium foliorum* as a member of the *Convolvulaceae* with thick, green, cordate leaves, large white flowers, and "coriander-like" seeds. He reported that it was an aphrodisiac, a stimulating tonic, a cure for syphilis, an analgesic, a carminative, a cure for colds, and a help for sprains, fractures, pelvic cramps in women, and unnatural swellings. Mixed with milk and *Capsicum* spp., and applied to the head and forehead, it was thought to be a cure for certain eye troubles.[18]

De la Serna (30) attributed to ololiuqui intoxicating properties similar to those of peyote and teonanacatl.

Safford (23,24) doubted that ololiuqui was a member of the *Convolvulaceae* on the basis of negative results in pharmacological experiments with the seeds of *Rivea corymbosa*. He suggested that ololiuqui was *tolouche*, *Datura ceratocaula* Hook. (11) or *D. meteloides* Dunal (24), because reports of ololiuqui- or piule-intoxication indicated symptoms similar to those common in *Datura*-intoxication.

Pharmacological work has only recently succeeded in proving the presence of an active principle in *Rivea corymbosa*. Santesson (26) has found that piule (ololiuqui seeds) contains a gluco-alkaloid which is almost inactive physiologically until hydrolysis occurs. This constituent fails to give positive alkaloid reactions until, on hydrolysis with hydrochloric acid, the alkaloid is set free and reacts to standard alkaloid tests. Chemical identification of this gluco-alkaloid is needed. Although Santesson admits that "ein solcher Körper ist meines Wissens eine Seltenheit," the possibility that more such masked alkaloids exist in some of these unusual Mexican plant intoxicants is not remote. Conditions resembling this exist in the glucosides of *Digitalis* spp. *(digitalin)* and *Strophanthus* spp. *(strophanthin)* where the constituents themselves are poisonous, but their decomposition products harmless.

The effects of ololiuqui (piule) had been described (16) as not definitely narcotic, but "hypnotic-somnambulistic." The condition of the subject under piule-intoxication is very similar to hypnotism, whence the use of the plant by sorcerers. Santesson (26) confirms this with pharmacological experimentation on frogs, where partial cerebral paralysis results in a sluggish and passive condition of the animal, which he calls "eine Art Narkose, oder Halbnarkose."

There are many medicinal plants in the genus *Ipomoea* (1) with which *Rivea corymbosa* has close relation-

ships. The medicinal properties are due to the presence of irritant and purgative resins (6, 33). *Ipomoea Purga* Hayne is the best known of the score or more medicinal members of the genus.

That members of the genus *Ipomoea* were well known medicinals in Central America before the arrival of the Spanish is demonstrated by the inclusion of species of *Ipomoea* in many ancient Mayan prescriptions (21). Among those used, the following were important: *Ipomoea pentaphylla* Jacq., a medicinal for earaches (gum) and for eczema (leaves); *I. sinuata* Ort., found to be used as a general panacea; *I. carnea* Jacq. which provided, in its leaves and roots, an antidote for certain poisons; the juice of the leaves of *I. Meyeri* G. Don which was used for earaches, while the fruit, prepared with other plant ingredients, was employed as a laxative. An unidentified plant, *iz-can-ak* ("snake vine"), with tuberous roots and climbing habit (probably a member of the *Convolvulaceae*) found use as a remedy for sores on the eyes (21). Hernandez (8) reported this use for ololiuqui among the Aztecs.[18]

The chemistry of the *Convolvulaceae* is imperfectly known. The exact constitution of the resins of the group is unknown, but the active principles are all glucosides, with the exception of the gluco-alkaloid recently reported in *Rivea corymbosa* (26). The resins of the *Convolvulaceae* are classed as *glucoretin* (33). A number of glucosides have been reported in the family, but it is now believed that there is only one: *convolvulin (jalapin, jalapurgin, scammonin); turpethin* is now thought to be impure convolvulin, and *pharbitisin* and *ipomoein* to be mixtures of constituents (33). It is evident that the *Convolvulaceae* present a promising field for further research in botany, ethnobotany, chemistry, and pharmacology.

III. Plants known as "peyote"

A list of those plants which, in Mexico, are popularly classed as "peyote" would include, in addition to the *Convolvulaceae* described above, the following: among the *Cactaceae*—*Ariocarpus fissuratus* (Engelm.) K. Schum. (16), *A. retusus* Scheidw. (2), and *A. kotschoubeyanus* (Lem.) K. Schum. (2), *Astrophytum myriostigma* Lem. (18), *A. asterias* (Zucc.) Lem. (3), and *A. capricorne* Dietrich (3), *Pelecyphora aselliformis* Ehrenb. (3), *Strombocactus disciformis* DC. (3), *Aztekium ritterii* Boedeker[19] (16), *Obregonia denegrii* Fric.[20] (16), *Dolichothele longimamma* Britton & Rose (4), and *Solisia pectinata* Britton & Rose (4); among the *Crassulaceae*—*Cotyledon caespitosa* Haw. (4) and several other species (16); among the *Compositae*—*Cacalia cordifolia* HBK. (34,22) and probably also several other species (34), *Senecio calophyllus* Hemsl. (4), *S. Hartwegii* Benth. (4), *S. Grayanus* Hemsl. (15), *S. tolucanus* DC. (15), *S. cervariaefolius* Sch. Bip. (4), and *S. albo-lutescens* Sch. Bip. (12); among the *Leguminosae*—*Rhychosia longeracemosa* Mart. & Gal. (15); and among the *Solanaceae*—*Datura meteloides* DC. ex Dunal (15).

All of these "peyotes" are said to be either narcotic or medicinal, a fact which seems to lend support to the Reko etymology. Chemical corroboration of these reported properties is impossible in many cases because of the lack of investigation of these somewhat obscure plants. *Anhalin*, the one "anhalonium alkaloid" usually absent in *Lophophora Williamsii*, has been found in several species of *Ariocarpus* (36) and is thought to be present in the other members of the *Cactaceae* known as *peyote*. *Astrophytum myriostigma*, *A. asterias*, *A. capricorne*, *Pelecyphora aselliformis*, *Dolichothele longimamma*, and *Solisia pectinata* have not been investigated

thoroughly as yet, but are reported (15) to have traces of toxic alkaloids.

The *Crassulaceae* have received very little chemical attention, but the species of *Cotyledon* called *pegote*, which are reported as causing insanity, contain a powerful glucoside (15). Many species of *Cotyledon* have known medicinal properties and are used in various parts of the world as vulneraries (5).

No chemical investigation has been carried out with *Cacalia cordifolia*. This "peyote" is thought by Urbina (34) and Safford (22) to have been the *Peyotl Xochimilcensis* of Hernandez, although Martinez (12) believes it to be *Senecio albo-lutescens* Sch. Bip., another "peyote." However, *Cacalia cordifolia (cachane)* is offered for sale in the drug markets of Jalisco as an aphrodisiac and as a cure for sterility (22). Due to the closeness of the genus *Cacalia* to *Senecio*, a genus rich in active principles, it seems probable that *Cacalia* may possess glucosides or alkaloids.

Of the more than 1200 species of *Senecio* in all parts of the world, many are used medicinally because of their bitter and astringent properties, and many are known to be poisonous (5). Although none of the species listed above has been chemically investigated, the possibility that alkaloids or glucosides may exist in these Mexican species is not remote. The following active principles have been reported in *Senecio* spp.: *senecionin*, *senecin*, *seneciofolin*, and *seneciofolidin* (6, 36).

Rhynchosia longeracemosa has never been studied chemically and, therefore, is not known to possess an active principle. The *Leguminosae*, however, are not lacking in a large number of active glucosides and alkaloids.

Datura meteloides is a well-known narcotic plant and needs no discussion beyond pointing out that Safford, likening the seeds of this plant to those of *Ipomoea* spp.,

and believing piule-intoxication, as reported by older writers, to show symptoms comparable to intoxication from *Datura* spp., considered ololiuqui to be this *Datura* (23, 24).

IV. Indian names of Lophophora Williamsii

The Indian names for *Lophophora Williamsii* are of particular interest. All of the tribes of the United States and some Mexican tribes use the term *peyote*. Since peyote has spread northward recently in the United States, the origin of the native names of peyote of several tribes is interesting. In several cases, I have found that the native word for "medicine" has been applied to the cactus while frequently retaining its original meaning. This suggests that the medicinal properties may be of fundamental importance in the diffusion of the peyote-cult throughout the plains and other tribes.

In Mexico, the native names are: among the Cora of Tepic Mountains—*huatari (houatari);* the Tarahumare of Chihuahua—*houanamé, hikuli (hikoli, jicoli), hikori, hikuli wanamé* (a very large plant, possibly a species of *Mammillaria*), *hikuli walúla saeliami* ("peyote of great authority"), and, in songs only, *joutouri* ("symbolic plant"); the Tepehuane of Durango —*kamba* or *kamaba;* the Huichol of Jalisco—*hicouri (hicori, jicori, xicori)* and *hikuli;* the Opata—*pejori;* the Otomi—*beyo;* and, according to Martinez(11),among the ancient Aztecs—*teocomitl ahuitzyo* ("spineless biznaga").

In the United States, there are almost as many names for the narcotic as there are tribes acquainted with it. Among the Mescalero-Apache of New Mexico—*ho;* the Kiowa, Comanche, and Wichita of Oklahoma—*señi, wokowi (wohoki)* and *nezats*, respectively; the Winnebago of South Dakota—*huñka* (the Father Peyote).

I have found that the Kickapoo and Shawnee of Ok-

lahoma use the pre-peyote word for "medicine" to designate peyote (*Lophophora Williamsii*) *naxe-tai-no-nee* and *o-jay-bee-kee* respectively. In addition, the Kickapoo have naturalized the word *pee-yot* into their language: in this case, the word, formerly referring only to the cactus, has acquired the meaning of "medicine." Cases similar to this are reported in the literature, where, for example, the Omaha word *makan* ("medicine") now means "peyote"; this is true also for the Delaware *bii-sung* and the Taos *walena*.

V. Conclusion

A summary of the common names and taxonomic nomenclature of those members of the complex of plants known as *peyote* or confused or associated with *Lophophora Williamsii* follows:

Biznaga

CACTACEAE

Lophophora Williamsii (Lem.) Coult.

This term is apparently applied indiscriminately to many plants.

Cactus-pudding

CACTACEAE

Lophophora Williamsii (Lem.) Coult.

Challote

CACTACEAE

Lophophora Williamsii (Lem.) Coult.

Chautle (chaute)

CACTACEAE

Ariocarpus fissuratus (Engelm.) K.Schum.

A. retusus Scheidw.

Diabolic root (devil's root, raiz diabolica)

CACTACEAE

Lophophora Williamsii (Lem.) Coult.

Dry whiskey

CACTACEAE

Ariocarpus fissuratus (Engelm.) K. Schum. (erroneous application)

Lophophora Williamsii (Lem.) Coult.

Dumpling cactus

CACTACEAE

Lophophora Williamsii (Lem.) Coult.

Mescal

AMARYLLIDACEAE

Agave spp.

CACTACEAE

Lophophora Williamsii (Lem.) Coult.

Mescal bean

CACTACEAE

Lophophora Williamsii (Lem.) Coult.

LEGUMINOSAE

Erythrina spp.

Sophora secundiflora (Orteg.) Lag. ex DC.

Mescal button

CACTACEAE

Lophophora Williamsii (Lem.) Coult.

Ololiuqui

CACTACEAE

Lophophora Williamsii (Lem.) Coult.

CONVOLVULACEAE

Ipomoea spp. (?)

Rivea corymbosa (L.) Hall. f.

SOLANACEAE

Datura ceratocaula Hook. (erroneous application)

D. meteloides Dunal (erroneous application)

Peyote

CACTACEAE

Ariocarpus fissuratus (Engelm.) K. Schum.
A. kotschoubeyanus (Lem.) K. Schum.
A. retusus Scheidw.
Astrophytum asterias (Zucc.) Lem.
A. capricorne Dietrich
A. myriostigma Lem.
Aztekium ritterii Boedeker
Dolichothele longimamma Britton & Rose
Obregonia denegrii Fric.
Pelecyphora aselliformis Ehrenb.
Solisia pectinata Britton & Rose
Strombocactus disciformis DC.

COMPOSITAE
Cacalia cordifolia HBK.
Cacalia spp. (?)
Senecio albo-lutescens Sch. Bip.
S. calophyllus Hemsl.
S. cervariaefolius Sch. Bip.
S. Grayanus Hemsl.
S. Hartwegii Benth.
S. tolucanus DC.

CRASSULACEAE
Cotyledon caespitosa Haw.
Cotyledon spp.

LEGUMINOSAE
Rhynchosia longeracemosa Mart. & Gal.

SOLANACEAE
Datura meteloides Dunal

Peyote buttons

CACTACEAE
Lophophora Williamsii (Lem.) Coult.

Peyote cimarron

CACTACEAE
Ariocarpus fissuratus (Engelm.) K. Schum.

Astrophytum myriostigma Lem.

COMPOSITAE

Senecio Hartwegii Benth.

ORCHIDACEAE

Bletia campanulata LaLlave & Lex.

Cranichis (?) speciosa LaLlave & Lex.

Peyotillo

CACTACEAE

Dolichothele longimamma Britton & Rose

Solisia pectinata Britton & Rose

Pelecyphora aselliformis Ehrenb.

Piule

CACTACEAE

Lophophora Williamsii (Lem.) Coult.

CONVOLVULACEAE

Ipomoea spp. (?)

Rivea corymbosa (L.) Hall.f.

LEGUMINOSAE

Rhynchosia longeracemosa Mart. & Gal.

Pithecellobium arboreum (L.) Urb.

Teonanacatl (nanacatl)

CACTACEAE

Lophophora Williamsii (Lem.) Coult. (erroneous application)

A mushroom as yet unknown.

Tuna de tierra

CACTACEAE

Lophophora Williamsii (Lem.) Coult.

Turnip cactus

CACTACEAE

Lophophora Williamsii (Lem.) Coult.

White mule

CACTACEAE

Lophophora Williamsii (Lem.) Coult.

FOOTNOTES

[1] For the background of the present paper, *vide*: Schultes, Richard Evans: "Peyote and plants used in the peyote ceremony" Bot. Mus. Leafl., Harv. Univ., vol. 4, no. 8, Cambridge, April 12, 1937.

[2] The botanical nomenclature of this cactus is as confused as the popular names, the result of more than 100 years of taxonomic controversy. Taxonomists are far from agreement at the present time. It will be sufficient for the purposes of this paper to mention that, since its discovery by Europeans, peyote (*Lophophora Williamsii*) has been classified under the following names:

Lophophora Williamsii (Lemaire) Coulter in Contrib. U. S. Nat. Herb., vol. 3, 1894.

Peyotl zacatecensis Hernandez in De hist. plant. Nov. Hisp., 1638.

Echinocactus Williamsii Lemaire in Allg. Gartenz., vol. 13, p. 385, 1845.

Ariocarpus Williamsii Voss in Vilmorin's Blumengärtn., p. 368, 1872.

Anhalonium Williamsii Lemaire in Förster's Handb. Cact., ed. 2, p. 233, 1885.

Anhalonium Lewinii Hennings in Gartenfl., vol. 37, p. 410, 1888.

Mammillaria Williamsii Coulter in Contrib. U. S. Nat. Herb., vol. 2, p. 129, 1891.

Anhalonium rungei Hildmann in Monatschr. f. Kakteenk., vol. 3, p. 68, 1893.

Anhalonium subnodusum Hildmann in Monatschr. f. Kakteenk., vol. 3, p. 68, 1893.

Lophophora Williamsii lewinii Coulter in Contrib. U. S. Nat. Herb., vol. 3, p. 131, 1894.

Anhalonium Jourdanianum Lewin in Ber. Deutsch. Bot. Gesel., vol. 12, p. 289, 1894, and in Monatschr. f. Kakteenk., vol. 6, p. 180, 1896.

Mammillaria Lewinii Karsten in Deutsch. Fl., ed, 2, vol. 2, p. 457, 1895.

Echinocactus Lewinii Hennings in Monatschr. f. Kakteenk., vol. 5, p. 94, 1895.

Anhalonium visnagra Hildmann in Monatschr. f. Kakteenk., vol. 6, p. 174, 1896.

Lophophora Williamsii Thompson in Rept. Mo. Bot. Gard., vol. 9, p. 133, 1898.

Echinocactus Jourdanianus Rebut in Monatschr. f. Kakteenk., vol. 15, p. 122, 1905.

In the cases of *Anhalonium visnagra*, *A. rungei*, and *A. subnodusum*, the plants were described, but not figured. The descriptions leave little doubt but that the plants were different forms of *Lophophora Williamsii* (3).

[3] The following synonyms of *Ariocarpus retusus* appear in the literature as additional peyote-cactuses: *Anhalonium prismaticum* Lem., *Mammillaria prismatica* Hemsl., *Cactus prismaticus* Kuntze, *Anhalonium furfuraceum* Coult., *Mammillaria furfuracea* S. Wats., *Anhalonium pulvilligerum* Lem., and *Anhalonium elongatum* Salm-Dyck.

[4] This plant is unknown.

[5] Augustin Hunt y Cortes, author of this etymology, also gives *pepeyoni* the significance of "child" (20).

[6] Siméon (31) defines *peyotl* or *peyutl* as: "Plante dont la racine servait à fabriquer une boisson qui tenait lieu de vin; cocon de ver à soie; pericarde, enveloppe du coeur."

[7] Hernandez (8) used this word as a name for a plant characterized by a particularly strong odor, which he described under the title: *De Yauhtli.*

[8] Spinden (32) gives to *guayule* the entirely different meaning of "old-fashioned rubber." This he derives from an etymology in which the word *hue* or *guay* ("old") and the word *ulli* ("rubber") are combined to form *guayule.*

[9] *Sophophora secundiflora* contains a narcotic alkaloid *(cytisine)* capable of rendering a person unconscious for long periods. For a detailed account of mescal beans (*Sophora secundiflora* and *Erythrina* spp.) consult the reference in footnote 1.

[10] *Dry whiskey* is also erroneously applied to *Ariocarpus fissuratus* (Engelm.) K. Schum.

[11] It is recorded (10) that, during the Civil War, a group of Texas Rangers were captured, and, due to food shortage, came near starvation. They were saved by Indian friends who smuggled mescal buttons in to them. The captives used the buttons for food, calling them "white mule," a name which has survived for *Lophophora Williamsii* in rural parts of Texas.

[12] Reko (17) points out philologically that *teonanacatl* means "divine food of a soft or fleshy nature." In this light, it is difficult to see how the term ever could have referred to the corky, though succulent, peyote, much less to hard, brittle mescal buttons.

[13] "Tenian así mismo gran conocimiento de yerbas y raízes, y conocian sus calidades y virtudes; ellos mismos descubrieron y usaron primero la raíz que llaman *peiotl*, y los que comian y tomaban, la usaban en lugar de vino, y lo mismo hacien de los que llaman *nanacatl* que son los hongos malos que emborrachan tambien como el vino . . . " (25).

[14] "Hay unos honguillos en esta tierra que se llaman *teonanacatl*, crianse debajo del heno en los campos ó páramos; son rundondos, tienen el pie altillo, delgada y redondo, comidos son de mal sabor, dañan la garganta y emborrachan: son medicinales contra las calenturas y la gota: hanse de comer dos ó tres no mis: los que los comen ven visiones y sienten bascas en el corazon, á los que comen muchos de ellos provocan á lujuria, y aunque sean pocos" (25).

[15] Reko (15) states that two *Leguminosae: Rhynchosia longeracemosa* Mart. & Gal. and *Pithecellobium arboreum* (L.) Urb., are also called *piule*. Both are narcotic, and *Rhynchosia longeracemosa* is also known as *peyote*. This evidence, together with the fact that Sahagun (25) described a plant probably belonging to the *Solanaceae* as *ololiuqui*, tends to suggest that, as in the case of *peyote*, many plants are classed under the terms *ololiuqui* and *piule*.

[16] "Hay otra yerba que se llama *ololiuhqui ó xixicamatic*, tiene las hojas como de *miltomatl*, ralas las flores, son amarillas, no son de provecho ellas, ni las hojas, ni ramas" (25).

[17] Hay una yerba que se llama *coatlxoxouhqui*, y cria una semilla que se dice *ololiuhqui;* esta semilla emborracha y enloquece, danla por bebidzos para hacer daño á los que quieren mal, y los que la comen paréceles que ven visiones y cosas espantables; danla á comer ó á beber, los hechiceros ó los que aborrecen á algunos para dáñarlos. Esta yerba es medicinal, y su semilla usase para la gota moliéndola y poniéndola en el lugar donde está (25).

[18] Attention is called to the fact that this use of ololiuqui was one of the many medicinal uses of several species of *Ipomoea* among the Maya (21).

[19] *Aztekium ritterii* Boedeker in Monatschr.f. Deutsch. Kakt. Gesel., vol. 3, p. 52, 1929.

[20] *Obregonia denegrii* Fric. in Zeitschr.f. Sukkultenk., vol. 3, p. 184, 1927-28.

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ARNOLD COLLEGE
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BOTANICAL MUSEUM LEAFLETS
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NEW ORCHIDS FROM CENTRAL AMERICA

BY
CHARLES SCHWEINFURTH

THE FOLLOWING NEW SPECIES from Central America, mostly from Costa Rica, have been proposed as the result of a study of a large collection recently made in Costa Rica.

The arrangement of the genera is in accordance with the Engler and Prantl system of classification.

Malaxis nana *C. Schweinfurth sp. nov.*

Herba nana, epiphytica. Caulis brevis, inferne bulbosus, prope medium bifoliatus. Folia inaequalia, ovata. Inflorescentia umbelliformis. Flores pro planta magni. Perianthii partes late patentes. Sepala anguste triangulari-lanceolata, perlonge acuminata; lateralia obliqua. Petala triangulari-linearia. Labellum triangulari-ovatum vel ovato-lanceolatum, longe acuminatum, paene planum. Columna minuta.

Plant dwarf, up to 6.5 cm. high to the tip of the largest erect leaf. Roots fibrous, lanuginose. Stem about 2 cm. long, bulbose-thickened at the base, clothed below with two imbricating sheaths and with the sheathing petioles of the leaves. Leaves two, about opposite, erect or widely spreading, very unequal in size, sessile except for the long-sheathing base, broadly ovate, acute, in the dried plant membranaceous with a prominently carinate mid-

nerve, the larger one about 4.6 cm. long and 2.65 mm. wide. Peduncle (above the leaves) arcuate, about 1.7 cm. long, striate-angulate especially above. Inflorescence umbelliform. Floral bracts triangular-lanceolate, acuminate, up to about 4 mm. long. Pedicels numerous, very slender, with the ovary up to about 1.4 cm. long, narrowly several-winged above. Flowers large for the plant. Perianth segments widely spreading. Sepals and petals membranaceous. Dorsal sepal narrowly triangular-lanceolate, gradually long-acuminate, up to 7.6 mm. long and 1.25 mm. wide near the base, indistinctly 3-nerved below. Lateral sepals asymmetrically triangular-lanceolate, long-acuminate with conduplicate sides above forming a curved apex, up to 8 mm. long and 1.6 mm. wide near the base, 4-nerved below. Petals triangular-linear, long-acuminate, 1-nerved, up to 6 mm. long and 0.5 mm. wide at the base. Lip ovate-lanceolate with the upper third rather abruptly long-acuminate, up to 6.4 mm. long and 2.55 mm. wide near the rounded base, 3-nerved in the lower portion. Column very short and stout, about 1.1 mm. long.

In another collection, *Brenes (131) 1334*, both leaves are spreading, the larger one being about 4.2 cm. long and 2.2 cm. wide. The peduncle is merely flexuous. Dorsal sepal about 6 mm. long and 1.25 mm. wide near the base. Lateral sepals about 6.1 mm. long and 1.2 mm. wide, 3-nerved below. Petals 6 mm. long, about 0.5 mm. wide at the base. Lip about 5.1 mm. long and 2.1 mm. wide near the base, long-acuminate above.

Malaxis nana is distinct from all Middle American species of the genus with regard to its congested habit. It differs from *M. corymbosa* (S. Wats.) O. Ktze. in having a narrower and more gradually acuminate lip. It varies from *M. tenuis* (S. Wats.) Ames in having an umbelliform inflorescence and dissimilar basal portion of the lip.

Costa Rica, "Bois à San Pedro de San Ramón. Epiphyte, de 7 cm. haut. Alt. 850 m. 27-VI-1925. Infl. pas plus longue que les feuilles." *A.M.Brenes (96) 1301* (Type in Herb. Ames No.44337); "Bosquet du Cerro de San Isidro de San Ramón. Alt. 1175 m. 10-VII-1925." *Brenes (131) 1334.*

Pleurothallis membraniflora (*C. Schweinfurth sp. nov.*

Herba nana, epiphytica, caespitosa. Radices fibrosae. Caules graciles, vaginis arctis tubularibus cum ostiis ciliatis ommino obtecti. Folia obovata, in sicco coriacea, marginata. Racemi fasciculati, laxe pauciflori. Flores parvi, membranacei. Sepala dorso carinata. Sepalum dorsale oblongo-lanceolatum, trinervium. Sepala lateralia omnino libera, anguste triangulari-lanceolata, leviter falcata, uninervia. Petala perparva, inconspicua, elliptico-ligulata. Labellum simplex, oblongum, apice basique late rotundatum, trinervium. Columna late bialata.

Plant dwarf, caespitose, up to 4.8 cm. tall. Roots fibrous, numerous, glabrous, as stout as the stems. Stems slender, bearing one or more leaves, up to 5 cm. long (an old stem), commonly 3.3 cm. or less long, closely and entirely invested by usually four to seven tubular nervose-angulate minutely hispid sheaths which terminate in spreading ovate marginate ciliate mouths. Leaves obovate, gradually narrowed to a shortly petioled base: lamina up to 9 mm. long, 4–5 mm. wide, marginate, minutely bilobed and apiculate at the rounded apex, erect, coriaceous, with the apical margins minutely cartilaginous-serrulate. Inflorescences fascicled at the apex of the stems and frequently also at several lower nodes of the stem, loosely up to 4-flowered. Flowers very small, membranaceous. Sepals parallel, about equally long. Dorsal sepal oblong-lanceolate, subacute, concave, about 3 mm. long and 1.5 mm. wide, 3-nerved through the lower half with the nerves prominently carinate on the

outer surface. Lateral sepals entirely free, narrowly triangular-lanceolate, slightly falcate, scarcely 3 mm. long, about 0.9 mm. wide, acute, 1-nerved with a prominent keel on the outer surface. Petals very small and diaphanous, about 1 mm. long and 0.25 mm. wide, about equaling the column, narrowly elliptic-ligulate, acute or subacute, oblique at the apex, 1-nerved through the lower half. Lip simple, oblong, membranaceous, subsessile, about 1.4 mm. long and 0.6 mm. wide, very slightly broader near the base, broadly rounded at base and apex, with three approximate nerves, slightly undulate on the margins. Column inconspicuous, about 1 mm. long, winged on each side throughout.

Pleurothallis membraniflora is vegetatively very similar to *P. Broadwayi* Ames, but is distinct in having minute petals and an entirely simple oblong lip without any thickenings.

Costa Rica, San Pedro de San Ramón. "29-VII-1935." *A.M. Brenes* (Herb. Brenes 20.571) (Type in Herb. Ames No. 44322.)

Epidendrum pinniferum *C. Schweinfurth sp. nov.*

Herba robusta. Caules alti, caespitosi, vaginis tubularibus aretis ommino obtecti. Folia numerosa, disticha, elliptica vel elliptico-lanceolata. Inflorescentia terminalis, perbrevis, subsessilis, basi bifurcata; rami pauciflori, decurvati. Flores subcarnosi. Sepala petalaque late patentia. Sepala oblongo-elliptica. Petala cuneato-spathulata. Labellum columnae valde adnatum, trilobatum; lobi laterales subquadrato-dolabriformes, patentes; lobus medius sessilis, late flabellatus, apice truncatus, retusus, minute apiculatus. Columna apice truncato denticulata.

Plant tall, doubtless epiphytic. Roots fibrous, stout. Stems caespitose, about 73 cm. tall, terete, entirely concealed by close tubular sheaths which are leaf-bearing except in the lower portion, the sheathed stems up to 6 mm.

in diameter. Leaf-sheaths densely dark-verrucose. Leaves numerous, distichous, elliptic to elliptic-lanceolate, 7.6–11 cm. long, 1.5–2.8 cm. wide, acute and more or less complicate at the apex, cuneate toward the base, many-nerved, chartaceous in the dried specimen. Inflorescence very short, terminal, subsessile, bifurcate at the base, subtended by a lanceolate foliaceous bract; the two branches of the rachis apparently stout, recurved, 2-to 4-flowered, about 2.7 cm. or less long. Flower medium-sized, perianth segments reflexed-spreading, rather fleshy. Dorsal sepal oblong-elliptic, about 1.45–1.6 cm. long and 6–7 mm. wide, obtuse or subacute, many-nerved. Lateral sepals similar, slightly asymmetric, about 1.55–1.68 cm. long and 7 mm. wide, acute, dorsally slightly carinate with the keel much thickened at the apex. Petals cuneate-spatulate, more or less asymmetric near the apex, about 1.4–1.5 cm. long and 5.5–6 mm. wide above, obtuse or subacute. Lip adnate to the column about to the middle of the latter, deeply 3-lobed, suborbicular-quadrate in outline, abruptly cuneate below and long-decurrent on the column to its base, retuse at the apex, about 1.68 cm. long from the base of the column to the apex of a terminal lobule and 1.75–1.9 cm. wide across the lateral lobes; lateral lobes subquadrate-dolabriform, spreading, irregularly crenulate or subdentate on the outer margins; mid-lobe sessile, broadly flabellate, abruptly retuse and apiculate forming a pair of divergent lobules with truncate-rounded apex and irregular-undulate sides, about 1.48 cm. wide across the lobules; disc minutely verrucose except near the margins, obscurely bicallose at base, with the mid-nerve conspicuously callose-thickened especially near the apex; two lateral nerves on each side are somewhat thickened. Column short, stout, infundibuliform, about 8 mm. long; the truncate apical margin denticulate and abruptly thrice cut posteriorly, producing

a pair of subquadrate-oblong lobules. Pedicellate ovary slender, about 3.3 cm. long.

Epidendrum pinniferum suggests several other species. It differs from *E. enemidophorum* Lindl. in having an abbreviated subsessile inflorescence and much broader mid-lobe of the lip. It is dissimilar to *E. Edwardsii* Ames in having shorter broader leaves, a nearly sessile inflorescence and much larger flowers.

The specific name, meaning fin-bearing, is in allusion to the lobes of the lip (particularly the mid-lobe) which simulate the fins of a fish.

COSTA RICA, "'Matamba' (lugar situado entre Pirrís y San Jerónimo), 14-V-1936." *Alfredo Brade 335* (TYPE in Herb. Ames No. 44326.)

Maxillaria campanulata *C. Schweinfurth sp. nov.*

Herba magna, crassa, caulescens. Caulis vaginis distichis dense imbricantibus omnino obtectus. Pseudobulbi distantes, valde complanati, anguste ellipsoidei, monophylli. Folia ligulata. Inflorescentiae numerosae, uniflorae, singulae in vaginarum axillis. Flos nutans, campanulatus. Sepala oblanceolato-oblonga, acuminata. Petala similia, minora. Labellum parvum, apice trilobatum: loborum lateralium pars libera porrecta triangulari-ovata, rotundata: lobus medius semiorbicularis, concavus: discus in medio callo apice trilobulato ornatus.

Plant apparently tall and stout (stem incomplete in our specimen), caulescent. Pseudobulbs ancipitous in the dried specimen, narrowly ellipsoid, about 4.5 7 cm. long, up to 2.4 cm. wide, monophyllous, distichously surrounded at base by two or three pairs of spreading leaf-bearing sheaths, about 17.5 cm. apart on the stem. Stem entirely concealed by distichous imbricating strongly complanate sheaths of which those on the younger growths bear small ovate-oblong conduplicate deciduous blades. Leaves ligulate, gradually narrowed into an in-

distinct channelled conduplicate petiole, up to about 38 cm. long and 2.8 cm. wide, rather abruptly acute, chartaceous, with the mid-nerve sulcate above and conspicuously carinate beneath. Inflorescences 1-flowered, numerous, solitary in the axils of the complanate distichous sheaths of the stem; peduncles short, arcuate, about 4.9 cm. long, entirely concealed below by several imbricating complanate nervose sheaths. Pedicellate ovary slender, arcuate-decurved, about 1 cm. long, subtended by an ovate concave abruptly acute bract which is about 2.1 cm. long. Flower nodding, campanulate. The upper portion of the sepals and petals is more or less spreading. Dorsal sepal oblanceolate-oblong, about 2.2 cm. long and 7.2 mm. wide above the middle, acuminate, many-nerved. Lateral sepals similar, about 2.35 cm. long and 8 mm. wide. Petals similar to the sepals but smaller, acuminate, about 1.9 cm. long and 5 mm. wide. Lip relatively small, sessile, slightly recurved and longitudinally tubular-involute in natural position, 3-lobed at the apex, when expanded the lamina is suborbicular-obovate, about 9 mm. long and 7.6 mm. wide; free portion of lateral lobes porrect, triangular-ovate, broadly rounded; mid-lobe semiorbicular, concave, 2 mm. long, 4 mm. wide, separated from the lateral lobes (which it scarcely exceeds) by a deep sinus. Center of disc provided with a subquadrate apically 2- or 3-lobulate callus and near the base in the middle with several inconspicuous warts. Column stout, slightly arcuate, flattened on the anterior surface, about 7 mm. long.

Another collection (Brenes 178) shows a cluster of fibrous glabrous roots. Its single pseudobulb is about 7.5 cm. long and 2.9 cm. wide. The leaf on the pseudobulb is about 45.2 cm. long and 3 cm. wide. The floral bract is about 2.3 cm. long, and the parts of the flower are a little larger than in the type collection.

The specific name is in allusion to the bell-shaped flower.

Maxillaria campanulata differs from *Camaridium latifolium* Schltr. in having the pseudobulbs surrounded by leaf-bearing sheaths and in having a much smaller lip which lacks the central beard on the disc. It differs from *C. costaricense* Schltr. in bearing pseudobulbs and in having a lip without the conspicuous basal band of papillae.

Costa Rica, "Tablazo? 14-X-1935." *Salvador Jiménez C. 315* (Type in Herb. Ames No. 44323.)

Oncidium graciliforme *C. Schweinfurth sp. nov.*

Herba epiphytica, gracilis. Rhizoma crassum, lignosum. Pseudobulbi complanato-cylindracei vel anguste ellipsoidei, monophylli, utrinque foliis fulti. Folia ligulato-linearia. Inflorescentiae perlaxe paniculatae, cum ramis brevibus. Perianthii partes late patentes. Sepala similia, oblanceolato-spathulata, apice rotundata. Petala oblongo-spathulata. Labellum panduratum, in circuitu subquadratum, apice retuso et leviter apiculato, basi callo apice dentato ornatum. Columna brevis, crassa, apice bialata.

Plant slender with a much thickened woody rhizome which produces numerous stout fibrous roots and, in our specimens, terminates in a pseudobulb. Pseudobulb cylindric to narrowly ellipsoid, about 3 cm. long, strongly complanate and longitudinally striate-sulcate in the dried specimen, monophyllous, distichously surrounded by two or three pairs of conduplicate leaf-sheaths of which the largest (inner) sheath is 9 cm. long. Leaves linear-ligulate, about 14–23.5 cm. long, 10–12 mm. wide, often conduplicate throughout, unequally bilobed and apiculate at the rounded apex, chartaceous in the dried specimen. Inflorescence a long lax paniele arising from the base of the pseudobulb, up to about 51.6 cm. long, more

or less surpassing the leaves; branches short, diffusely forking, apparently up to 8-flowered. Flowers lax, membranaceous, parts of the perianth spreading. Lateral sepals free, oblanceolate-spatulate, slightly asymmetric, minutely and obliquely retuse at the rounded apex with a dorsal subapical mucro, about 8.8 mm. long and 2.9 mm. wide near the apex, 1-nerved throughout and 3-nerved to above the middle, with the mid-nerve dorsally carinate to above the middle. Dorsal sepal very similar, about 8.3–8.8 mm. long and 3–3.2 mm. wide above. Petals asymmetrically spatulate-oblong, minutely acute or slightly emarginate at the rounded apex, about 9–10 mm. long and 4–4.5 mm. wide near the apex, 3-nerved to above the middle with forking veins. Lip subquadrate-panduRate in outline, retuse and apiculate in front, truncate or slightly cordate at base, about 11.8–13 mm. in greatest length; basal part transversely oval, about 9.1–9.8 mm. broad, semiorbicular-dilated on each side; anterior part separated by an isthmus about 4 mm. wide, abruptly reniform, about 10–11.5 mm. wide, consisting of two suborbicular lobules. Disc of lip with a basal obovate shortly pubescent callus which is 3- to 5-dentate at the apex. Column short, stout, arcuate, about 4.2 mm. long (without the anther), provided below with a pair of porrect, fleshy semioblong or semielliptic pubescent cheeks and above with a pair of very short and broad subdolabriform wings which are irregularly lacerate or bilobed. Anther incumbent, obliquely conic, lying on the prominent triangular rostellar process. Pollinia two, complanate-suborbicular.

Oncidium graciliforme appears to be closely allied to the polymorphic *O. obryzatoides* Kränzl. Its claim to distinctness lies chiefly in its relatively very slender habit and vegetative parts as well as in the transversely oval basal part of the lip.

Panama, Chiriqui. Epiphyte at 4000-5000 feet altitude. March 1923. *C. W. Powell 3227* (Referred to *Powell 157*). (Type in Herb. Ames No. 27603.)

Dichaea gracillima *C. Schweinfurth sp. nov.*

Herba pergracilis, silvicola. Caules caespitosi vel prope basim ramosi, tenues, vaginis foliorum omnino obtecti, parte basali plus minusve defoliati. Folia numerosa, disticha, anguste linearia, erecto-patentia, ad vaginas imbricantes apice patentes articulata. Inflorescentiae numerosae, uniflorae, breves, singulae in foliorum axillis. Sepalum dorsale elliptico-lanceolatum, concavum, acutum. Sepala lateralia ovato-lanceolata, valde concava, acuminata. Petala ovato-elliptica, acuminata. Labellum in circuitu late obovatum, parte basali subquadrata, parte anteriore abrupte anchoriformi-dilatata cum auriculis brevibus retrorsis.

Plant very slender, caespitose or branching near the base. Roots fibrous, nearly as stout as the stems (where naked). Stems slender, erect or arcuate, up to about 30 cm. long, entirely concealed by imbricating leaf-sheaths which are leafless and waste into fibres near the base in old plants. Leaves articulated, distichous, numerous, narrowly linear, up to 4.7 cm. long and 2 mm. wide, shortly acuminate and apiculate, erect-spreading, commonly conduplicate below the middle. Inflorescences numerous, 1-flowered, solitary in the leaf-axils; pedumeles about 1 cm. or more long, filiform, concealed at the base by two imbricating cylindrical scarious sheaths and terminating in a scarious shallowly infundibuliform acute bract which encloses a linear bracteole. Flower small, submembranaceous. Dorsal sepal elliptic-lanceolate, strongly concave, about 5 mm. long and 2.2 mm. wide, acute, 3-nerved, dorsally carinate at the apex. Lateral sepals ovate-lanceolate, strongly concave, asymmetric, about 5 mm. long and 2.5 mm. wide below the middle, acuminate, dorsal-

ly unicarinate, 4-nerved with the anterior nerve extending only through the lower half. Petals ovate-elliptic, acuminate with a complicate apex, about 4.2 mm. long and 2.1 mm. wide, 3-nerved. Lip obovate in outline, concave, abruptly anchor-shaped-dilated near the broad apex, abruptly acute, shortly clawed, about 4 mm. long, 7-nerved; lower portion of lamina subquadrate, abruptly rounded at the base, about 2 mm. long and 2.1 mm. wide; anterior portion abruptly dilated with a short retrorse triangular-lanceolate lobule on each side, nearly 4 mm. wide when expanded. Column very short and stout, about 1.6 mm. long, with an inconspicuous erect shallowly rounded infrastigmatic process. Pollinia four, in two unequal pairs, complanate-subpyriform.

The habit of this species suggests a very slender form of *Dichaea Powellii* Schltr., but the very narrow leaves and abruptly subquadrate basal portion of the lip are diagnostic.

The description of the flower was made from a single (perhaps immature) flower in which the segments were connivent.

Costa Rica, Piedades de San Ramón. "Bois. Alt. 1100 m. 26-X-1925." *A. M. Brenes (274) 1459* (Type in Herb. Ames No. 45278.)

NOMENCLATORIAL CHANGES

BY

OAKES AMES

THE FOLLOWING CHANGES have been made necessary because of the conservation of *Zeuxine* and *Goodyera*.

Zeuxine benguetensis *Ames comb. nov.*

Adenostylis benguetensis Ames in Elmer Leafl. Philipp. Bot. 5 (1912) 1551; Orch. 5 (1915) 39; in Merrill Enum. Philipp. Flow. Pl. 1 (1924) 275.

Zeuxine Elmeri *Ames comb. nov.*

Adenostylis Elmeri Ames in Elmer Leafl. Philipp. Bot. 5 (1912) 1552; in Philipp. Journ. Sci. 8 (1913) Bot. 408; Orch. 5 (1915) 39; in Merrill Enum. Philipp. Flow. Pl. 1 (1924) 275.

Zeuxine leytensis *Ames comb. nov.*

Adenostylis leytensis Ames Orch. 5 (1915) 39; in Merrill Enum. Philipp. Flow. Pl. 1 (1924) 276.

Zeuxine luzonensis *Ames* in Philipp. Journ. Sci. 2 (1907) Bot. 314, *nomen; comb. nov.*

Adenostylis luzonensis Ames Orch. 2 (1908) 57, text cut; Orch. 5 (1915) 39; in Merrill Enum. Philipp. Flow. Pl. 1 (1924) 276.

Adenostylis Vanoverberghii Ames in Philipp. Journ. Sci. 8 (1913) Bot. 408; Orch. 5 (1915) 40; in Merrill Enum. Philipp. Flow. Pl. 1 (1924) 277.

Zeuxine marivelensis *Ames comb. nov.*

Adenostylis marivelensis Ames Orch. 2 (1908) 58, text cut; Orch. 5 (1915) 39; in Merrill Enum. Philipp. Flow. Pl. 1 (1924) 276.

Zeuxine philippinensis *Ames* in Sched. Orch. Corrigenda (1938) xxxvii.

Adenostylis philippinensis Ames in Sched. Orch. 6 (1923) 9; in Merrill Enum. Philipp. Flow. Pl. 1 (1924) 276.

Zeuxine Weberi *Ames comb. nov.*

Adenostylis Weberi Ames Orch. 5 (1915) 40; in Merrill Enum. Philipp. Flow. Pl. 1 (1924) 277.

Zeuxine zamboangensis *Ames* in Sched. Orch. Corrigenda (1938) xxxvii.

Adenostylis zamboangensis Ames in Sched. Orch. 6 (1923) 10; in Merrill Enum. Philipp. Flow. Pl. 1 (1924) 277.

Goodyera Elmeri *Ames* in Sched. Orch. Corrigenda (1938) xxxvii.

Epipactis Elmeri Ames in Sched. Orch. 6 (1923) 12.

A NEW PLEUROTHALLIS FROM MEXICO

BY

CHARLES SCHWEINFURTH

Among the interesting orchids collected by E. Matuda in the south of Mexico is the following one belonging to the large group of rather closely allied species entering around *Pleurothallis cardiothallis* Reichb. f. Its floral characters, however, apparently do not permit of its inclusion in any known species.

Pleurothallis Matudiana *C. Schweinfurth sp. nov.*

Herba mediocris, caespitosa. Caules numerosi, basi et infra medium vagina tubulari ornati. Folium singulum, saepissime erectum, oblongo-ovatum vel ovatum, basi cordatum. Inflorescentiae unifloraе, fasciculatae. Flores parvi, ringentes, bilabiati. Sepalum dorsale valde concavum, ovatum. Sepala lateralia in laminam acriter bidentatam late ovatam connata. Petala anguste linearia, inferne crenulata. Labellum ovato-oblongum, crassissimum, acutum. Columna subgeneris.

Plant medium-sized, up to about 32 cm. tall to the tip of the erect leaf. Roots fibrous, numerous, filiform, glabrous. Stems caespitose, numerous, up to about 24 cm. tall, slender, provided at the base and below the middle with a tubular-cylindric scarious evanescent sheath. Leaf solitary, erect or spreading, oblong-ovate or ovate, strongly cordate at the base, about 7.7–11 cm. long including the basal auricles, up to 3.7 cm. wide, acute or acuminate with a minutely tridenticulate tip, coriaceous. Flowers in the sinus between the basal lobules of the leaf, surrounded by a small conduplicate spathe. Flower small, ringent, bilabiate. Dorsal sepal concave, ovate, acute, about 8.7 mm. long in natural position and 5.7 mm. wide, 3-nerved. Lateral sepals connate into a sharply bidentate

lamina which is broadly ovate, about 8.2 mm. long and 4.7 mm. wide, concave below, 6-nerved, bicarinate dorsally. Petals parallel to and surrounding the lip in natural position, slightly exceeding the lip, narrowly linear, slightly falcate below, about 7.5 mm. long and 0.9 mm. wide, acute, 1-nerved, minutely crenulate below. Lip very shortly and broadly unguiculate; lamina ovate-oblong, cordate at base, very thickly fleshy, slightly recurved and longitudinally sulcate in natural position, about 5.2 mm. long from a basal auricle to the tip, 2.7 mm. wide across the dilated base, with a minute incurved apicule at the tip, above the middle minutely crenulate on the margins. Column short, very stout, characteristic of the allied group of species.

Another collection, *E. Matuda S-200*, differs from the type in having shorter stems, smaller more ovate leaves (as small as 6.6 cm. long) and smaller flowers.

Pleurothallis Matudiana is vegetatively similar to many species of the alliance of *P. cardiothallis* Reichb. f. In particular, it differs from the Costa Rican *P. phyllocardia* Reichb. f. in having only a small and inconspicuous spathe surrounding the flowers and in having very narrow petals and lip.

Mexico, State of Chiapas, Siltepec. August 8, 1937. *E. Matuda 1577* (Type in Herb. Ames No. 46687); State of Chiapas, Mt. Pasitar. August 3-4, 1937. *E. Matuda S-200.*

MALAXIS CONFUSA, A NEW COMBINATION

BY

CHARLES SCHWEINFURTH

Malaxis confusa *(Cogn.) C. Schweinfurth comb. nov.*

Microstylis confusa Cogniaux in Urban Symb. Antill. 6 (1909) 370.

The above combination has apparently not been made.

In the Gray Herbarium is a sheet (No. 2816) bearing two plants. One of them, *C. Wright 614* (Plantae Cubenses Wrightianae 1856-7, in Cuba Orientali) is the type number of *Microstylis confusa*. This specimen is an old one and bears on the summit of the rachis the remnants of a mature flower on a swollen ovary. It differs from the type description in having a floral bract up to 7 mm. long, not 1.5–2 mm. long as cited for *Microstylis confusa*.

The other (left-hand) plant is a good specimen bearing a raceme of flowers and buds. Its larger leaf is only 8.5 cm. long. A flower from this specimen shows further differences. Its dorsal and lateral sepals are both about 2 mm. wide. The lip is oblong-ovate, submembranaceous and scarcely exceeds 3 mm. in width. Furthermore, the following color-notes are given: "Sep. & pet. light greenish Lip dull reddish-green turning to orange. . . . Potosi Monte Toro Oct 11". A second label reads: "Plantae Cubenses Wrightianae" and bears the legend, presumably in Grisebach's writing, "=614 which had no. fl." and also, in print, "Coll. C. Wright 1860--1864".

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ORCHID STUDIES, IV

BY
LOUIS O. WILLIAMS

THE ORCHIDS OF THE FIJI ISLANDS

THE FOLLOWING ANNOTATED CATALOGUE of the Fijian orchids was prepared when a large collection made by *John W. Gillespie* and by *H. E. Parks* was received for study and determination at the Botanical Museum of Harvard University. This collection contains about two hundred specimens many of which will be found in the herbarium of Oakes Ames; duplicates of most of the Gillespie numbers, as well as some numbers of the Parks collections, will be found in the Bernice P. Bishop Museum in Honolulu; duplicates of most of the Parks collections and some of those of the Gillespie collection will be found in the herbarium of the University of California.

In addition to the above collections, I have had access to three others from Fiji. The first collection (of about thirty numbers) is that of *A. C. Smith*, of which the study set is in the Ames Herbarium. The second is the *Seemann* collection, of which duplicates of many species are in the Gray Herbarium. This collection is of particular importance because it formed the basis for *H. G. Reichenbach's* treatment of the orchids in Seemann's Flora Vitiensis. The third collection is that of the United States South Pacific Exploring Expedition, of which a good representation is to be found in the Gray Herbar-

ium. Most of the specimens of the last collection, in the Gray Herbarium, have been annotated by Reichenbach and some of them are probably isotypes of Reichenbachian species. Unfortunately the specimens of this collection are unnumbered and consequently, unless they have been annotated by Reichenbach, are occasionally difficult to place.

It is hoped that all the species which have been described or reported from the Fiji Islands are included in this paper, but it is quite probable that a few have been overlooked. All the specimens which I have seen and have been able to determine are cited. Those which I have not seen but which were reported in literature as having been collected in Fiji have been included and enclosed in parentheses to indicate that they have not been seen.

There are probably a few species included in this report which do not occur in Fiji. Possibly some of these species, representatives of which I have not seen, may belong to genera other than those to which they have been referred.

The range, beyond Fiji, of all the species of orchids is given in general terms. These statements of range have been taken from various sources. Most of them have been derived from literature, but some have been taken from specimens in the Ames Herbarium and in the Gray Herbarium. No particular attempt has been made to verify the occurrence, outside of Fiji, of any plant reported in literature.

Thanks are due to Professor Oakes Ames who has assisted in many ways and to Professor Elmer D. Merrill who has been kind enough to loan the orchid part from his Polynesian index, thereby greatly simplifying the enumeration of the Fijian orchids.

A LIST OF THE SPECIES

HABENARIA *Willdenow*

Habenaria alaeformis *C. Schweinfurth* in B. P. Bishop Mus. Bull. 141 (1936) 17, fig. 6a.

FIJI: *Smith 257; Gillespie 3759; Parks 20051, 20897.*

Habenaria cynosorchidacea *C. Schweinfurth* in B. P. Bishop Mus. Bull. 141 (1936) 18, fig. 6b.

FIJI: *Smith 1364; Gillespie 3187, 3756; Parks 20897 in part.*

Habenaria maculifera *C. Schweinfurth* in B. P. Bishop Mus. Bull. 141 (1936) 18, fig. 6c.

FIJI: *Smith 427, 1911.*

This species may not be distinct from *H. tradescantifolia.*

Habenaria superflua *Reichenbach filius* in Seemann Fl. Vit. (1868) 293.

FIJI: *Seemann 608; Wilkes U. S. South Pacif. Expl. Exped.; Parks s.n.*

Samoa, Society Islands (?).

Habenaria supervacanea *Reichenbach filius* in Seemann Fl. Vit. (1868) 293.

FIJI: *Wilkes U.S. South Pacif. Expl. Exped.; (Graeffe).*[1]
Samoa.

Habenaria tradescantifolia *Reichenbach filius* in Seemann Fl. Vit. (1868) 293.

FIJI: *Seemann 608 in part; Gillespie 2036,2256,2438,2442,3008, 3278; Parks 20231, 20346; Wilkes U. S. South Pacif. Expl. Exped.; (Gibbs 659).*

Samoa, Society Islands (?).

[1]Parentheses indicate that the specimen has not been seen, but the reference taken from literature.

CRYPTOSTYLIS *R. Brown*

Cryptostylis vitiensis *Schlechter* in Fedde Repert. 3 (1906) 16.

Fiji: *(Thompson); Gillespie 4052; Smith 1638.*

VANILLA *Swartz*

Vanilla anomala *Ames & Williams sp. nov.*

Herba epiphytica [scandens?]. Folia coriacea, lanceolato-oblonga vel oblongo-ovata, acuta vel obtusa. Inflorescentia in ramis lateralibus terminalis, pauciflora: bracteae coriaceae, cucullatae, obtusae. Sepalum dorsale elliptico-lineare, tri- vel quinque-nervium, acutum. Sepala lateralia elliptico-linearia, apice cucullata, acuta. Petala linearia, acuta vel obtusa, leviter falcata. Labellum obovatum, integrum vel apice paulo laceratum, basi breviter saccatum, callo plano carinato longitudinali omnino percursum et papillis carnosis ornatum. Columna aliquid dimorphica. Anthera et stigma generis.

A [scandent?] epiphytic herb of unknown length, but in specimens available up to 3 dm. long. Stem strongly fractiflex, angled (at least when dry), enlarged at the nodes; internodes on the apical part 1–10 cm. long; lateral branches short, fractiflex, subtended by a leaf, borne alternately from the nodes and with an air-root opposite to the fertile branch at each node. Leaves coriaceous, lanceolate-oblong to oblong-ovate, acute or obtuse, 1–7 cm. long or probably longer and 0.5–4 cm. broad or probably broader. Inflorescence terminal on the lateral branches, few-flowered, about 1 cm. long; bracts coriaceous, cucullate, obtuse, not deciduous, about 1–2 mm. long. Flowers 2–2.5 cm. long. Dorsal sepal elliptic-linear, 3–5-nerved, acute, 2–2.5 cm. long and about 4 mm. broad. Lateral sepals elliptic-linear, about 9-nerved, slightly cucullate at the apex, acute, 2–2.5 cm. long and about 5

mm. broad. Petals linear, acute or obtuse, slightly falcate, about 5-nerved, 2–2.5 cm. long and 2–3 mm. broad. Lip obovate, entire or the apical portion slightly cut, about 20 mm. long and 12 mm. broad, adnate to the column for only about 2–3 mm. at the base and forming a short sac: a flattened carinate callus (attached to the lip only medianly) extending from the base to the apex: the upper surface of the lip more or less covered with fleshy papillae. Column somewhat dimorphic, slender, slightly arcuate:—form a—with a flattened, fleshy, dorsal process beginning about 2 mm. from the apex of the column and extending over the apex with the anther attached terminally:—form b—with a terete dorsal filament beginning about 3 mm. from the apex of the column and reaching to, or nearly to, its apex, with the anther terminal; anther and stigma of the genus.

Vanilla anomala has much the aspect of a *Galeola* and, in sorting the bundle in which it was contained, it was tentatively labelled *Galeola*. A careful examination, however, indicates that it is best referred to *Vanilla*. Among the species of *Vanilla*, it does not seem to have any near allies. It is possible that the species is one which is somewhat intermediate between the species of *Vanilla* and those of *Galeola*.

The slightly dimorphic condition of the column, described above, is not known to occur in any other species of *Vanilla* (or in *Galeola* for that matter) known to us. A number of flowers were dissected and about an equal number of each column-form was found. It seems, so far as we are able to determine, that flowers having either form of column are functionally perfect. A few very young fruits are to be found on our specimens.

FIJI: Viti Levu, Naitisiri Province, vicinity of Nasinu, 9 miles from Suva. Epiphyte. At 150 meters altitude. October 29, 1927. *Gillespie 3630* (TYPE in Herb. Ames Nos. 46907 & 46908).

Vanilla fragrans *(Salisb.) Ames* in Sched. Orch. 7 (1924) 36.

Myrobroma fragrans Salisbury Parad. Lond. (1807) t. 82.

Vanilla planifolia Andrews Bot. Repos. 8 (1808) t. 538.

This species is said by Rolfe (Journ. Linn. Soc. Bot. 32 (1896) 445) to be cultivated in Fiji.

NERVILIA *Commerson ex Gaudichaud*

Nervilia aragoana *Gaudichaud* in Freycinet Voy. Uranie et Physic. Bot. (1826) 422, t. 35.

Pogonia flabelliformis Lindley Gen. & Sp. Orch. Pl. (1840) 415—Duthie in Ann. Roy. Bot. Gard. Calcutta 9 (1906) 158, t. 125.

Pogonia sp. Reichenbach filius in Seemann Fl. Vit. (1868) 296, probably.

Fiji: *Wilkes U.S. South Pacif. Expl. Exped.*; *Seemann 604.*
Widely distributed: India, Burma, Malaya to Samoa.

DIDYMOPLEXIS *Griffith*

Didymoplexis micradenia *(Reichb.f.) L.O. Williams comb. nov.*

Epiphanes micradenia Reichenbach filius in Seemann Fl. Vit. (1868) 295.

Leucorchis micradenia Bentham & Hooker filius ex Drake Ill. Fl. Ins. Pacif. (1886) 313.

Fiji: *(Seemann 610).*

GOODYERA *R. Brown*

Goodyera anomala *Schlechter* in Fedde Repert. 9 (1910) 86.

Fiji: *Smith 256, (1576).*
Samoa.

Goodyera rubicunda *(Bl.) Lindley* in Bot. Reg. 25 (1839) Misc. p. 61.

Neottia rubicunda Blume Bijdr. (1825) 408.
Rhamphidia rubicunda Reichenbach filius in Seemann Fl. Vit. (1868) 294.
Hetaeria rubicunda Bentham & Hooker filius ex Drake Ill. Fl. Ins. Pacif. (1886) 312.

Fiji: *Gillespie 3121.9.*
Malaya, Java, Sumatra, Celebes, Borneo, Moluccas, Amboina, Philippines, New Caledonia, New Guinea, Samoa.

Goodyera Waitziana *Bl.* var. **vitiensis** *L. O. Williams var. nov.*

A specie lobo medio labelli transverse ovali differt.

The variety differs from the species in having the mid-lobe of the lip transversely oval instead of oblong, hence the sinuses are quite noticeable whereas they are obscure in the species.

Fiji: Koro. Terrestrial, dense forest. Perianth yellow and salmon pink. At 300-500 meters altitude. January 29 to February 5, 1934. *Smith 1062* (Type in Herb. Ames No. 42090).

ZEUXINE *Lindley*

Zeuxine sphaerocheila *Fleischmann & Rechinger* in Denkschr. Math.-Naturw. Klasse K. Akad. Wiss. Wien 85 (1910) 251, t. 2, fig. 6—C. Schweinfurth in B. P. Bishop Mus. Bull. 141 (1936) 19.

Fiji: *Smith 225, 798.*
Samoa.

Zeuxine stricta *(Rolfe) L. O. Williams comb. nov.*

Adenostylis stricta Rolfe ex Gibbs in Journ. Linn. Soc. Bot. 39 (1909) 177.

Fiji: *(Gibbs 667).*

Zeuxine vitiensis *(Rolfe) L. O. Williams comb. nov.*
Adenostylis vitiensis Rolfe ex Gibbs in Journ. Linn. Soc. Bot. 39 (1909) 177.

Fiji: *(Gibbs 618).*

ODONTOCHILUS *Blume*

Odontochilus longiflorus *(Reichb.f.) Bentham & Hooker filius ex Drake* Ill. Fl. Ins. Pacif. (1886) 312.
Anectochilus longiflorus Reichenbach filius in Seemann Fl. Vit. (1868) 294.
?Odontochilus upoluensis Kränzlin in Mitteil. Instit. allgem. Bot. Hamb. 5 (1922) 236.

Fiji: *(Seemann 601); Wilkes U.S. South Pacif. Expl. Exped.; Smith 1628; (Gibbs 701).*

?Samoa

ANOECTOCHILUS *Blume*

Anoectochilus vitiensis *Rolfe ex Gibbs* in Journ. Linn. Soc. Bot. 39 (1909) 176.

Fiji: *(Gibbs 635).*

VRYDAGZYNEA *Blume*

Vrydagzynea purpurea *Blume* Fl. Jav. Orch. (1858) 60, t. 20— Reichenbach filius in Seemann Fl. Vit. (1868) 294.

Fiji: *(Seemann 618).*
Java.

Vrydagzynea vitiensis *Reichenbach filius* Otia Bot. Hamb. (1878) 51.

Fiji: *(Wilkes U. S. South Pacif. Expl. Exped.).*

HETAERIA *Lindley*

Hetaeria forcipata *Reichenbach filius* in Linnaea 41 (1876) 62.

Fiji.

Hetaeria Francisii *Schlechter* in Fedde Repert. 9 (1911) 161.

Fiji: *(Francis).*

Hetaeria oblongifolia *Blume* Fl. Jav. Orch. (1858) 85, t. 32, fig. 3.

?Hetaeria similis Schlechter in Fedde Repert. 9(1910) 88.

There seems to be only a slight difference between Schlechter's *H.similis* and *H.oblongifolia* and the former is here placed tentatively under that species. Critical work will probably uphold this reduction.

Fiji: *Wilkes U.S. South Pacif. Expl. Exped. (?); Smith 135, 2008; Gillespie 2572, 2700, 3007.*

Java, New Guinea, Moluccas, Samoa.

Hetaeria polyphylla *Reichenbach filius* Otia Bot. Hamb. (1878) 52; Xen. Orch. 3 (1881) 29.

Fiji: *Wilkes U.S. South Pacif. Expl. Exped.; Prince s.n.*

TROPIDIA *Blume*

Tropidia ctenophora *(Reichb.f.) Bentham & Hooker filius ex Drake* Ill. Fl. Ins. Pacif. (1886) 311.

Cnemidia ctenophora Reichenbach filius Otia Bot. Hamb. (1878) 51.

Tropidia ctenophora Reichb.f. is probably conspecific with *T.effusa* Reichb.f. The original description of the lip as given by Reichenbach is obviously incorrect as is the drawing made by him which is now contained in his herbarium. The lip is shown as emarginate, and is so described with a query. The species undoubtedly has the apex of the lip strongly reflexed.

Fiji: *Wilkes U.S. South Pacif. Expl. Exped.; (Graeffe).*

Tropidia effusa *Reichenbach filius* in Seemann Fl. Vit. (1868) 295.

Fiji: *Seemann 612; Prince s.n.; Smith 972; Gillespie 2236, 3024, 4719; Parks 20202; (Graeffe).*

Samoa, Admiralty Islands.

CORYMBORCHIS *Thouars*

Corymborchis veratrifolia *(Reinw.) Blume* Fl. Jav. Orch. (1858) 105, t. 42.

Hysteria veratrifolia Reinwardt in Bot. Zeit. 2 (1825) 5.

Fiji: *Gillespie 4541, 4627a; Seemann 603.*

Widely distributed in the eastern tropics: India, Malaya to Samoa.

MALAXIS *Solander ex Swartz*

Malaxis brevidentata *C. Schweinfurth* in B. P. Bishop Mus. Bull. 141 (1936) 20, fig. 7a.

Fiji: *Smith 1620.*

Malaxis comans *C. Schweinfurth* in B. P. Bishop Mus. Bull. 141 (1936) 21, fig. 7b.

Fiji: *Smith 1684, 1739.*

Malaxis Everardii *(Rolfe) L. O. Williams comb. nov.*

Microstylis Everardii Rolfe in Kew Bull. (1921) 54.

Fiji: *(im Thurn).*

Malaxis Imthurnii *(Rolfe) L. O. Williams comb. nov.*

Microstylis Imthurnii Rolfe in Kew Bull. (1921) 53.

Fiji: *Gillespie 4456; (im Thurn 208).*

The Gillespie specimen has been determined from the characters.

Malaxis latisegmenta *C. Schweinfurth* in B. P. Bishop Mus. Bull. 141 (1936) 22, fig. 7c.

Fiji: *Smith 967.*

Malaxis latisepala *(Rolfe) C. Schweinfurth* in B. P. Bishop Mus. Bull. 141 (1936) 23.

Microstylis latisepala Rolfe in Kew Bull. (1921) 53.

Fiji: *Smith 271, 1063; Gillespie 4583; im Thurn 209.*

Malaxis longifolia *(Rolfe) L. O. Williams comb. nov.*

Microstylis longifolia Rolfe in Kew Bull. (1921) 54.

Fiji: *(Horne); Seemann 616 (?).*

Malaxis platychila *(Reichb.f.) O. Kuntze* Rev. Gen. Pl. 2 (1891) 673.

Microstylis platychila Reichenbach filius in Seemann Fl. Vit. (1868) 302—Kränzlin in K. Schumann & Lauterbach Fl. Deutsch. Schutzgeb. Südsee (1901) 242.

Fiji: *Seemann 590; Wilkes U.S. South Pacif. Expl. Exped.*
German New Guinea.

Malaxis purpurea *(Lindl.) O. Kuntze* Rev. Gen. Pl. 2 (1891) 673.

Microstylis purpurea Lindley Gen. & Sp. Orch. Pl. (1830) 20—Reichenbach filius in Seemann Fl. Vit. (1868) 302.

Fiji: *Seemann 613.*
New Zealand.

Malaxis radicicola *(Rolfe) L. O. Williams comb. nov.*

Microstylis radicicola Rolfe in Kew Bull. (1921) 53.

Fiji: *(im Thurn 64).*

Malaxis Schlechteri *(Rolfe) L. O. Williams comb. nov.*

Microstylis Schlechteri Rolfe in Kew Bull. (1921) 53, *in textu.*
Microstylis vitiensis Schlechter in Fedde Repert. 10 (1911) 249, non Rolfe.

Fiji: *(Lucae).*

Malaxis vitiensis *(Rolfe) L.O. Williams comb. nov.*
Microstylis vitiensis Rolfe ex Gibbs in Journ. Linn. Soc. Bot. 39 (1909) 173.

Fiji: *(Gibbs 653).*

OBERONIA *Lindley*

Oberonia glandulosa *Lindley* Fol. Orch. Oberonia (1859) p.6.
Malaxis glandulosa Reichenbach filius in Walp. Ann. 6 (1861) 215; in Seemann Fl. Vit. (1868) 302.

Fiji: *Seemann 588; Harvey; Wilkes U.S. South Pacif. Expl. Exped.; Parks 20174a, 20477; Smith 1485, 1731.*
Samoa, Society Islands, New Hebrides, Cook Islands.

Oberonia heliophila *Reichenbach filius* Otia Bot. Hamb. (1878) 56, *in textu.*
Malaxis heliophila Reichenbach filius Otia Bot. Hamb. (1878) 56.
Oberonia Betchei Schlechter in Bull. Herb. Boiss. 6 (1906) 303.

Fiji: *Seemann 587, 614; Wilkes U. S. South Pacif. Expl. Exped.; Parks 20174; Gillespie 2877; Smith 1732.*
Samoa.

LIPARIS *L.C. Richard*

Liparis condylobulbon *Reichenbach filius* in Hamb. Gartenz. 18 (1862) 34.
Liparis confusa J.J. Smith Fl. Buitenz. 6 (Orch. Jav.) (1905) 275.

Fiji: *Parks 20441, 20468; Setchell & Parks 15035.*
Malaya and Polynesia.

Liparis longipes *Lindley* in Wallich Pl. Asiat. Rar. 1 (1830) 31.

Fiji: *Seemann 614.*
India, China, Java, Samoa.

The specimen, on which the original report was based, may well be *L. condylobulbon*.

Liparis nesophila *Reichenbach filius* Otia Bot. Hamb. (1878) 56; Xen. Orch. 3 (1881) 31.

Fiji: *Wilkes U.S. South Pacif. Expl. Exped.*

Ridley has cited the Wilkes specimen under *L. longipes* Lindl. and has reduced *L. nesophila* Reichb.f. to that species.

Liparis vitiensis *Rolfe* in Kew Bull. (1921) 54.

Fiji: *(im Thurn 370); Parks 20369 (?).*

Presumably the Parks specimen belongs to Rolfe's species, but Rolfe's description of *L. vitiensis* is not very good and I have seen no authentic material of the species.

CHRYSOGLOSSUM *Blume*

Chrysoglossum Gibbsiae *Rolfe ex Gibbs* in Journ. Linn. Soc. Bot. 39 (1909) 175.

Fiji: *(Gibbs 886).*

Chrysoglossum ornatum *Blume* Bijdr. (1825) 308; Fl. Jav. Orch. (1858) 136, t. 46.

Fiji: *Gillespie 3196, 3199.1; Wilkes U.S. South Pacif. Expl. Exped.*
Java, Sumatra, Celebes.

Chrysoglossum vesicatum *Reichenbach filius* in Seemann Fl. Vit. (1868) 304.

Fiji: *(Seemann 611).*

COELOGYNE *Lindley*

Coelogyne sp.

Fiji: *Gillespie 4293.*

The genus *Coelogyne* does not seem to have been re-

ported previously from Fiji. This specimen, which is in fruit, has much the aspect of *C. asperata* Lindl.

PSEUDERIA *Schlechter*

Two species of this genus are known to occur in the Fiji Islands and there is also a third species of which the specimens are inadequate for critical diagnosis.

It seems rather peculiar that the flowering plants of this affinity were unknown to *H. G. Reichenbach* from Fiji at the time when he contributed the orchids to Seemann's Flora Vitiensis. Species of this genus have been rather common in recent collections from the Fiji group. An interesting note on *Pseuderia* by *Schlechter* is to be found in Engler Bot. Jahrb. 56 (1921) 473.

Pseuderia platyphylla *L. O. Williams sp. nov.*

Herba epiphytica (vel semi-epiphytica), usque ad 17 dm. alta. Folia lanceolata vel ovato-lanceolata, acuta vel acuminata. Inflorescentiae breves, laterales, pauciflorae; bracteae ovatae. Sepalum dorsale lineari-lanceolatum, acutum, carnosum, trinervium. Sepala lateralia similia. Petala linearia, acuta, trinervia. Labellum oblongo-ovatum, obtusum, simplex, carinis ornatum. Columna generis.

A robust epiphytic (or semi-epiphytic) herb up to about 17 dm. tall. Stems coarse, up to about 1.5 cm. thick; internodes 2–4 cm. apart. Leaves lanceolate to ovate-lanceolate, acute to abruptly acuminate, comparatively thin when dry yet coriaceous, 10–20 cm. long, 1.5–6 cm. broad. Inflorescences short, lateral and about opposite the base of a leaf, mostly less than 10-flowered, up to 5–6 cm. long (but mostly shorter); bracts ovate, mostly 4–6 mm. long. Flowers relatively large for the genus, about 1.5–2 cm. long. Dorsal sepal linear-lanceolate, acute, fleshy, 3-nerved, about 20 mm. long and 3

mm. broad. Lateral sepals linear-lanceolate, fleshy, acute, arcuate, 3- (5-) nerved, about 18 mm. long and 4 mm. broad. Petals linear, acute, 3-nerved, about 12 mm. long and 2 mm. broad. Lip oblong-ovate, obtuse, simple, with one strong median callus which divides into two carinae at the base and four smaller keels which converge to the main keel toward the base, 8–10 mm. long and about 4–5 mm. broad. Column of the genus.

Pseuderia platyphylla is closely allied to *P. diversifolia* J.J.Sm., a species which was described from Dutch New Guinea. The present species may be distinguished by the generally narrower leaves, by the oblong-ovate (not rhomboid) lip and by the fact that the lip is strongly reflexed near the base and not evenly reflexed for most of its length.

Fiji: Viti Levu, Mt. Konibalevu. Vine climbing tall trees. Flowers white. At 400 meters altitude. July 1927. *Parks 20928* (Type in Herb. Ames Nos. 46919 & 46920).

The following specimens from Fiji doubtless belong to this species: *Gillespie 2412, 3499, 3629; Parks 20927; Wilkes U. S. South Pacif. Expl. Exped.*

Pseuderia Smithiana *C. Schweinfurth* in B. P. Bishop Mus. Bull. 141 (1936) 23, fig. 7d.

Fiji: *Smith 161, 561; Gillespie 2166, 2177, 2264, 3639, 3883; Parks 20927; Setchell & Parks 15083.*

DENDROBIUM *Swartz*

Dendrobium biflorum *(Forst.) Swartz* in Nov. Act. Soc. Sci. Upsal. 6 (1799) 84; in Act. Holm. (1800) 246—Reichenbach filius in Seemann Fl. Vit. (1868) 303.

Epidendrum biflorum Forster Fl. Ins. Austral. Prodr. (1786) 60.

Fiji: *Seemann 582; Gillespie 3862: Parks 20027, 20569.*
Samoa, Solomon Islands, Society Islands, New Zealand.

Dendrobium catillare *Reichenbach filius* in Seemann Fl. Vit. (1868) 304.

The original description of this species is not very good and Kränzlin, in his monograph of the genus, was not able to clarify the species. The redescription given below is based on *Smith 871* and *905*. These specimens are in the herbarium of The New York Botanical Garden.

An epiphytic caespitose herb with simple stems up to 3 dm. long. Stems multiarticulate, slender, indurated, the segments mostly 1–2 cm. long, yellow, with the leaf-sheaths on the older ones disintegrated, the younger parts of the stem covered with leaf-sheaths. Leaves lanceolate, acute or somewhat obtuse, slightly bilobed, several-nerved, 2.5–5 cm. long, 0.6–1 cm. broad, articulated to the striated sheath which invests the stem, soon deciduous. Inflorescence short, borne on the leafless stems, mostly 2–5-flowered; bracts hyaline, obscurely maculate, lanceolate, acute, 4–7 mm. long, 2–3.5 mm. broad. Flowers medium-sized for the subgenus, about 1.8 mm. long, pink and white. Dorsal sepal lanceolate, obtuse, 3–5-nerved, about 9 mm. long and 3 mm. broad. Lateral sepals attached to the column-foot and forming with it a slightly curved obtuse mentum 8–9 mm. long which is closed for about 2 mm. at the base; free part of the blade lanceolate, acute, 5–7-nerved, about 8 mm. long and 4 mm. broad. Petals elliptic-oblanceolate, obtuse or acute, 3–5-nerved, about 10 mm. long and 3 mm. broad above the middle. Lip simple, unguiculate; claw slightly cochleate, about 5 mm. long and 2.2 mm. broad, with an inconspicuous callus at the junction with the blade; blade rhombic, the anterior half serrulate, ecallose, acute, several-nerved, 9–10 mm. long and 5–7 mm. broad. Column short, with two ovate lateral wings and a linear dorsal tooth at the apex.

Dendrobium catillare has much the habit of a small

D. Mohlianum Reichb.f., but is easily distinguished by the structure of the flowers. It belongs to the subgenus Pedilonum.

FIJI: *(Seemann 591); Smith 871, 905.*

Dendrobium dactylodes *Reichenbach filius* in Journ. Bot. 15 (1877) 132—Kränzlin in Engler Pflanzenr. IV. 50. II. B. 21 (1910) 189.

FIJI: *Wilkes U.S. South Pacif. Expl. Exped.*
Samoa, Cook Islands.

This specimen was determined by Reichenbach as *D. dactylodes.* It is sterile, but may well belong to this species.

Dendrobium Everardii *Rolfe* in Kew Bull. (1921) 55.

FIJI: *Gillespie 3172.5, 3830; (im Thurn 316, 326).*

Gillespie's number 3830 is somewhat smaller than the other specimen and than the plant described by Rolfe. These determinations have been made from the characters.

Dendrobium glossotis *Reichenbach filius* Otia Bot. Hamb. (1878) 55—Kränzlin in Engler Pflanzenr. IV. 50. II. B. 21 (1910) 101.

FIJI: *Wilkes U.S. South Pacif. Expl. Exped.; Parks 20188, 20210, 20544A, 20916.*
Society Islands.

Dendrobium Gordonii *S. Moore* in Journ. Linn. Soc. Bot. 20 (1883) 372—Rolfe ex Gibbs in Journ. Linn. Soc. Bot. 39 (1909) 174.

FIJI: *Wilkes U.S. South Pacif. Expl. Exped.; Gillespie 2111, 2276, 2942, 4156; Parks 20145, 20292, 20848; (Gibbs 603; Horne 942); Smith 1956 (?).*
Samoa.

The specimens determined as *D. Gordonii* are so named with reservations. I have not seen authentic specimens of that species and the little group (of a dozen or so species) to which it belongs is one of the most difficult in the genus.

Dendrobium Hornei *Baker* in Journ. Linn. Soc. Bot. 20 (1884) 373.

This species is probably not distinct from *D. Tokai* Reichb.f.

Fiji: *(Horne)*.

Dendrobium (Subg. Grastidium §. Bambusacea) **Kraenzlinii** *L.O. Williams nom. nov.*

Dendrobium vitiense Kränzlin in Mitteil. Inst. allgem. Bot. Hamb. 5 (1922) 263, non Rolfe 1921.

Fiji: *(Kleinschmidt)*.

Dendrobium Mohlianum *Reichenbach filius ex Mohl & Schlechtendal* in Bot. Zeit. 20 (1862) 214 Reichenbach filius in Bonpl. 10 (1862) 334, t. 16; in Seemann Fl. Vit. (1868) 303, t. 91.

The two plates cited above, which are copies of the same drawing, show the flowers to be deep red in color. The specimens examined seem to indicate (in the dry state) that the flowers were not red. Smith has noted the color of the five specimens which he collected as "bright orange" or "rich orange".

Fiji: *Gillespie 2783b, 3155, 3276, 3298, 5111; (Gibbs 620); Seemann 578; Parks 20608, 20756; Wilkes U.S. South Pacif. Expl. Exped.; Smith 269, 703, 1650, 1766, 1996; (Horne 793).*

Samoa, New Hebrides, New Guinea.

Dendrobium Mooreanum *Lindley* in Journ. Hort. Soc. Lond. 6 (1851) 272.

Fiji: *Wilkes U.S. South Pacif. Expl. Exped.*

New Hebrides.

This specimen, which is in the Gray Herbarium, was probably determined by Lindley but what remains of the specimen is sterile and the record cannot be further authenticated.

Dendrobium platygastrium *Reichenbach filius* Otia Bot. Hamb. (1878) 55; Xen. Orch. 3 (1881) 31.

Fiji: *Gillespie 3634; Wilkes U.S. South Pacif. Expl. Exped.*

Dendrobium Goldfinchii F.v. Mueller (in Wing South. Sci. Record (Jan. 1883)) is probably a synonym.

The specimens collected by the United States South Pacific Exploring Expedition were annotated by H.G. Reichenbach, but the name applied by him was never published. This unpublished name is similar to the one later adopted and probably Reichenbach altered it before he published his description of the species.

Dendrobium prasinum *Lindley* in Journ. Linn. Soc. Bot. 3 (1859) 11—Reichenbach filius in Seemann Fl. Vit. (1868) 304.

Sarcopodium prasinum Kränzlin in Engler Pflanzenr. IV. 50. II. B. 21 (1910) 322.

Fiji: *Agati's drawings; Seemann 596; Wilkes U.S. South Pacif. Expl. Exped.; Parks 20639; (Gibbs 663).*

The Agati drawings, in the Gray Herbarium, are doubtless the type of this most interesting species. Lindley in his description says, "A very distinct plant of which I only know a drawing by Agati, in the possession of my learned friend Prof. Asa Gray".

Dendrobium Seemannii *L.O. Williams nom. nov.*

Dendrobium calamiforme Rolfe in Kew Bull. (1921) 55, non Loddiges 1841.

Dendrobium crispatum sensu Reichenbach filius in Seemann Fl. Vit. (1868) 303.

Fiji: *Seemann 579; (Horne 1085; im Thurn 376).*
New Hebrides, Society Islands.

The Seemann specimens have received considerable attention; determined originally by Seemann as *D. calamiforme* Lodd., a synonym of *D. teretifolium* R. Br., they were placed in *D. crispatum* (Forst.) Sw. by H.G. Reichenbach in Seemann's Flora Vitiensis. Rolfe described the plant as new in 1921 under the name *D. calamiforme*, a name which may not be used, according to the present rules, because of the previous *D. calamiforme* Lodd.

Dendrobium serratum *Rolfe ex Gibbs* in Journ. Linn. Soc. Bot. 39 (1909) 174.

Fiji: *(Gibbs 610).*

Dendrobium (Subg. Dendrocoryne §. Tokai) **spathulatum** *L.O. Williams sp. nov., t.*

Herba epiphytica, robusta, usque ad 7 dm. longa. Caules teretes vel paulo complanati, multiarticulati, foliosi. Folia elliptico-oblonga, obtusa, apice inaequaliter bilobata, mox deciduа. Inflorescentiae laterales, folia excedentes: bracteae ovato-lanceolatae, obtusae. Sepalum dorsale elliptico-oblongum, obtusum, quinque-ad septemnervium. Sepala lateralia similia. Petala spathulata, obtusa vel leviter acuta. Labellum late elliptico-obovatum, tricarinatum; lobi laterales erecti, obtusi; lobus medius transverse oblongo-ovatus. Columna generis.

A large epiphytic herb about 7 dm. long. Stem terete or somewhat flattened, multiarticulate, leafy, about 1 cm. thick at the base, segments 1-5 cm. (in the middle of the stem about 4 cm.) apart. Leaves elliptic-oblong, obtuse, unequally bilobed at the apex, coriaceous, many-nerved, probably soon deciduous, 7–9 cm. long, 2.5–3.5 cm. broad. Inflorescence lateral, arising opposite the base

of a leaf toward the top of the plant, much exceeding the leaves in length, 10–20-flowered, the floriferous branches up to about 25 cm. long; bracts ovate-lanceolate, obtuse, 2–3 mm. long. Flowers about 1.5 cm. long. Dorsal sepal elliptic-oblong, obtuse but minutely apiculate, 5–7-nerved, about 10 mm. long and 5 mm. broad. Lateral sepals similar but about 14 mm. long to the base of the mentum which is not closed. Petals spatulate, broadest toward the apex, obtuse or minutely acute, about 12 mm. long and 4 mm. broad. Lip 3-lobed, broadly elliptic-obovate, about 14 mm. long and 11 mm. broad, joined with the column-foot for about 5 mm. at the base thus forming a short spur, with three carinae extending from near the base of the lip to a little beyond the sinuses (the carinae end in raised mamillae); lateral lobes erect, obtuse, 8–10 mm. long; mid-lobe transversely oblong-oval, about 4 mm. long and 6 mm. broad. Column about 4 mm. long with a broad foot of equal length; margin of the clinandrium serrulate and with a lanceolate dorsal mucro about 0.5 mm. long.

Dendrobium spathulatum is an interesting addition to the small section Tokai and is amply distinct from the other species of the section. It is most closely allied to *D. Tokai* Reichb.f., and specimens of the two species without flowers would be difficult to separate. The many contrasts in the flowers, however, will quickly separate them. *Dendrobium spathulatum* has flowers about one half the size of those of *D. Tokai;* the sepals and petals are differently shaped; and the lip is markedly different in shape.

Fiji: Viti Levu, Naitasiri Province, woods near road past Tamavua village, 6 miles from Suva. At 150 meters altitude. August 8, 1927. *Gillespie 2145* (Type in Herb. Ames No. 47527).

Dendrobium tipuliferum *Reichenbach filius* in Gard. Chron. n.s. 7 (1877) 72.

EXPLANATION OF THE ILLUSTRATION

DENDROBIUM SPATHULATUM *L.O.Williams*. 1, stem and leaves, one half natural size. 2, flower from below, about natural size. 3, flower from the front, about natural size. 4, column and lip seen from the side, enlarged about two and one half times. 5, lip expanded, enlarged about two and one half times.

Drawn by G.W.DILLON

DENDROBIUM *spathulatum*

L. O. Williams

Diplocaulobium tipuliferum Kränzlin in Engler Pflanzenr. IV. 50. II. B. 21 (1910) 335.

Fiji: *Smith 800, 1369; Wilkes U. S. South Pacif. Expl. Exped. (?); Gillespie 3831; Parks 20026; (Veitch).*

The Wilkes specimen was determined as *D. nitidissimum* Reichb.f. by H.G. Reichenbach. The specimen is sterile but is not that species, and probably is *D. tipuliferum* which apparently is quite common in Fiji.

Dendrobium Tokai *Reichenbach filius* in Hamb. Gartenz. 21 (1865) 293, t. 92; in Seemann Fl. Vit. (1868) 304, t. 90.

The specific name "Tokai" is said to be the Fijian vernacular name. Smith reports the same vernacular name for the plant.

Fiji: *Seemann 584; Wilkes U.S. South Pacif. Expl. Exped.; Parks 20443.*

Samoa.

Dendrobium vitiense *Rolfe* in Kew Bull. (1921) 56.

Fiji: *Gillespie 2038, 2399; Parks 20919; (im Thurn 317).*

ERIA *Lindley*

Eria aeridostachya *Reichenbach filius ex Lindley* in Journ. Linn. Soc. Bot. 3 (1859) 48—Reichenbach filius in Seemann Fl. Vit. (1868) 301.

The group of *Eria* to which this species belongs is most difficult and the delimitation of *E. aeridostachya* is not well understood. The reported distribution should be carefully scrutinized.

Fiji: *Seemann 609; Parks 20914.*

Malaya, Java, Sumatra, Philippines, Samoa.

Eria bulbophylloides *C. Schweinfurth* in B. P. Bishop Mus. Bull. 141 (1936) 24, fig. 7e.

Fiji: *Smith 452, 1815.*

Eria rostriflora *Reichenbach filius* in Seemann Fl. Vit. (1868) 301.

Eria Setchellii Schlechter ex Setchell in Univ. Calif. Publ. Bot. 12 (1926) 162.

Fiji: *Seemann 615; Wilkes U. S. South Pacif. Expl. Exped.; Gillespie 3838.*

Society Islands.

MEDIOCALCAR *J.J.Smith*

Mediocalcar sp.

This is the first report of the occurrence of Mediocalcar in Fiji. Unfortunately the specimen on which this report rests is sterile and cannot be determined. There are three species of the genus *Mediocalcar* known in Polynesia (*M. paradoxicum* (Kränzl.) Schltr., *M. ponapense* Schltr. and *M. vanikorense* Ames).

Fiji: *Parks 20560.*

AGROSTOPHYLLUM *Blume*

Agrostophyllum sp.

Fiji: *Wilkes U.S.South Pacif. Expl. Exped.; Gillespie 3163, 3247.4.*

The specimens at hand are much too mature for specific determination. They have much the aspect of *A. kaniense* Schltr., a native of New Guinea.

EARINA *Lindley*

Earina laxior *Reichenbach filius* Otia Bot. Hamb. (1878) 54; Xen. Orch. 3 (1881) 30—Rolfe ex Gibbs in Journ. Linn. Soc. Bot. 39 (1909) 175.

Fiji: *(Gibbs 586).*

Society Islands.

Earina plana *Reichenbach filius* Otia Bot. Hamb. (1878) 54; Xen. Orch. 3 (1881) 30.

It is probable that this species is identical with *E. laxior*. Reichenbach may have described *E. plana* from a juvenile specimen which he believed to be different from *E. laxior*. No mention of the flower structure is made in the description of either *E. laxior* or *E. plana* and it may be that the specimens were sterile. The Gillespie specimen is the only one with flowers which I have seen.

Fiji: *U. S. South Pacif. Expl. Exped.; Gillespie 3179; Smith 618, 2003.*

GLOMERA *Blume*

Glomera Gibbsiae *Rolfe ex Gibbs* in Journ. Linn. Soc. Bot. 39 (1909) 176.

Fiji: *(Gibbs 807).*

Glomera Macdonaldii *(Schltr.) J.J.Smith* in Nova Guinea 8 (1909) 44.

Glossorrhyncha Macdonaldii Schlechter in Fedde Repert. 3 (1906) 19.

Fiji: *Smith 701.*

New Hebrides.

Glomera montana *Reichenbach filius* in Linnaea 41 (1876) 77.

It is remarkable that this species was not included in the Flora Vitiensis, since I believe that Reichenbach had seen at least two specimens before the publication of that flora.

Fiji: *Seemann (possibly); Wilkes U. S. South Pacif. Expl. Exped.; Smith 681, 786.*

APPENDICULA *Blume*

Appendicula bracteosa *Reichenbach filius* in Seemann Fl. Vit. (1868) 299.

Lobogyne bracteosa Schlechter in Mem. Herb. Boiss. 21 (1900) 65.

Fiji: *Seemann 592; Wilkes U. S. South Pacif. Expl. Exped.; Gillespie 2206, 4691.5; Parks 20263, 20449.*

Samoa.

Appendicula pendula *Blume* Bijdr. (1825) 298.
Podochilus pendulus Schlechter in Mém. Herb. Boiss. 21 (1900) 48.

Fiji: *Smith 485, 1919.*

Java, Philippines, New Guinea, Samoa.

Appendicula reflexa *Blume* Bijdr. (1825) 229.
Appendicula cordata Hooker filius Fl. Brit. India 6 (1890) 83; in Hooker Icon. Pl. ser. 4, 11 (1893) t. 2148.
Podochilus reflexus Schlechter in Mém. Herb. Boiss. 21 (1900) 31.

Fiji: *Gillespie 2100, 2411, 2509; Parks 20105; Prince s.n.; Smith 631, 660, 854, 1806.*

India, Malaya.

CALANTHE *R. Brown*

Calanthe alta *Reichenbach filius* Otia Bot. Hamb. (1878) 53; Xen. Orch. 3 (1881) 30—Drake Ill. Fl. Ins. Pacif. (1886) 309.

Fiji: reported by Drake on a specimen collected by the "*U. S. Expl. Exped.*" The only specimen of *Calanthe* from Fiji which I have seen, collected on that expedition, is *C. hololeuca*.

Samoa.

Calanthe furcata *Bateman ex Lindley* in Bot. Reg. 24 (1838) Misc. p. 28.

Fiji: *Gillespie 4320, 4644; Smith 961, 1487, 1546.*

Widely distributed in the eastern tropics: India to Malaya and Australia.

Calanthe gracillima *Lindley* Fol. Orch. Calanthe (1854) p. 8.

Fiji: *Smith 737.*

Society Islands.

The material on which my identification rests is inadequate for a satisfactory diagnosis.

Calanthe hololeuca *Reichenbach filius* in Seemann Fl. Vit. (1868) 298.

Fiji: *Wilkes U. S. South Pacif. Expl. Exped.; Smith 403, 1376; Gillespie 4627; Parks 20066, 20106, 20270a, 20639a; Setchell & Parks 15078.*

Calanthe ventilabrum *Reichenbach filius* in Seemann Fl. Vit. (1868) 298.

Fiji: *Seemann 606; Smith 591, 667, 1886; Parks 20635, 20835; Gillespie 2388.*

PHAIUS *Loureiro*

Phaius Graeffei *Reichenbach filius* in Seemann Fl. Vit. (1868) 299.

Fiji: *Wilkes U.S. South Pacif. Expl. Exped.*

Samoa.

H.G. Reichenbach determined the Wilkes specimen and it apparently belongs to this species which was originally described from Samoa.

Phaius Tankervilliae *(Banks) Blume* Mus. Bot. Lugd.-Bat. 2 (1856) 177.

Limodorum Tankervilliae Banks ex L'Héritier Sert. Angl. (1778) 28.

Phaius grandifolius Loureiro Fl. Cochinch. (1790) 529.

Limodorum Incarvillei Blume Bijdr. (1825) 374.

Phajus Blumei Lindley Gen. & Sp. Orch. Pl. (1831) 127—Reichenbach filius in Seemann Fl. Vit. (1868) 299.

Phajus Incarvillei O. Kuntze Rev. Gen. Pl. 2 (1891) 675.

Fiji: *Smith 398, 909; Gillespie 2491, 3212; Parks 20270, 20279; (Seemann 586).*

Widely distributed in Australasia. Introduced in Cuba and Jamaica, possibly also in Brazil.

SPATHOGLOTTIS *Blume*

Spathoglottis pacifica *Reichenbach filius* in Seemann Fl. Vit. (1868) 300.

Fiji: *Harvey s.n.; Seemann 585; Smith 65, 378; Wilkes U.S.South Pacif. Expl. Exped.; Gillespie 2012, 2081, 5120; Parks 20448, 20724; Setchell & Parks 15061.*

New Hebrides, Society Islands, Wallis Islands, Samoa, Tonga Islands.

Spathoglottis plicata *Blume* Bijdr. (1825) 400, t. 76—Reichenbach filius in Seemann Fl. Vit. (1868) 300.

Fiji: *Gillespie 3162.6.*

Apparently rare in Fiji. Occurring on many of the Pacific Islands and on the Asiatic mainland. Introduced in Hawaii.

BULBOPHYLLUM *Thouars*

Bulbophyllum longiflorum *Thouars* Hist. Pl. Orch. (Orch. Iles Afr.) (1822) Tabl. Espèc. III & t. 98—Reichenbach filius in Seemann Fl. Vit. (1868) 302.

Cirrhopetalum Thouarsii Lindley in Bot. Reg. 10 (1824) sub t. 832—Hooker filius in Bot. Mag. 118 (1892) t. 7214.

The nomenclature of this species is confused in literature. I have accepted Thouars' name since there seems to be no reason for suppressing it, although the name proposed by Lindley has been more commonly used. Lindley's name is based on Thouars' combination which he cites in synonymy.

Fiji: *Seemann 598; U.S. South Pacif. Expl. Exped.; Gillespie 2550, 4385.*

Widely distributed in the eastern tropics.

Bulbophyllum longiscapum *Rolfe* in Kew Bull. (1896) 45.

Bulbophyllum praealtum Kränzlin (in Notizbl. Bot. Gart. Berlin 5 (1909) 109) is a probable synonym of this species. The relationship of this species is with **Bulbophyllum Macrolepis** *L. O. Williams nom. nov.* (*Macrolepis longiscapa* A. Rich. Sert. Astrolab. (1832) 25, t. 10), a species from the New Hebrides.

FIJI: *(Yeoward); Gillespie 2429.*

Bulbophyllum rostriceps *Reichenbach filius* Otia Bot. Hamb. (1878) 55; Xen. Orch. 3 (1881) 31.

FIJI: *Wilkes U.S. South Pacif. Expl. Exped.*

Bulbophyllum vitiense *Rolfe* in Kew Bull. (1893) 5.

FIJI: *(Yeoward).*

GEODORUM *Jackson*

Geodorum pictum *(R. Br.) Lindley* Gen. & Sp. Orch. Pl. (1833) 175—Rendle in Journ. Linn. Soc. Bot. 45 (1911) 251.

Cymbidium pictum R. Brown Prodr. Fl. Nov. Holl. (1810) 331.

FIJI: *Smith 1183.*
Australia, New Caledonia, New Guinea.

EULOPHIA *R. Brown*

This genus has not been reported previously from Fiji, so far as I have been able to discover. Two species are here reported, one a widely distributed species, the other known only from Guam and Fiji.

Eulophia Macgregorii *Ames* in Philipp. Journ. Sci. 9 (1914) Bot. 12.

FIJI: *Gillespie 4769.*
Guam.

The type of this species, *Macgregor 631* from Guam, is not very good but the Fiji specimens seem to represent it. The distribution is remarkable since the plant is known only from two islands, by single collections. There seems to be no other species to which the specimens could be satisfactorily referred.

Eulophia macrostachya *Lindley* Gen. & Sp. Orch. Pl. (1833) 183; in Bot. Reg. 23 (1837) t. 1972 —Hooker filius in Bot. Mag. 102 (1876) t. 6246—J. J. Smith Orch. Jav. Figuren-Atlas 2 (1909) t. 164.

Eulophia emarginata Blume Fl. Jav. Orch. (1858) 152.

Eulophia guamensis Ames in Philipp. Journ. Sci. 9 (1914) Bot. 12.

Fiji: *Gillespie 3644, 4702; Parks 20915.*

Ceylon, Java, Sumatra, New Guinea, Borneo, Philippines, New Hebrides, Guam, Palau.

PHREATIA *Lindley*

Phreatia cauligera *Reichenbach filius* Otia. Bot. Hamb. (1878) 55.

Eria cauligera Reichenbach filius Otia Bot. Hamb. (1878) 55; Xen. Orch. 3 (1881) 31.

Fiji: *Wilkes U.S. South Pacif. Expl. Exped.*

Phreatia Graeffei *Kränzlin* in Engler Pflanzenr. IV. 50. II. B. 23 (Heft 50) (1911) 26.

Eria sphaerocarpa Reichenbach filius in Seeman Fl. Vit. (1868) 301, non *Phreatia sphaerocarpa* Schltr.

Fiji: *(Graeffe); Gillespie 4264; Smith 89.*

Reported from Samoa by Setchell in Carnegie Inst. Bull. 341 (1924) 103.

Phreatia oreophylax *Reichenbach filius* Otia Bot. Hamb. (1878) 55; Xen. Orch. 3 (1881) 31 —Kränzlin in Engler Pflanzenr. IV. 50. II. B. 23 (Heft 50) (1911) 13.

This species was placed in section Octarrhena by Kränzlin, in his monograph, but it seems to be a Euphreatia.

Fiji: *Wilkes U. S. South Pacif. Expl. Exped.*

Phreatia stenostachya *(Reichb.f.) Kränzlin* in Engler Pflanzenr. IV. 50. II. B. 23 (Heft 50) (1911) 29.

Eria stenostachya Reichenbach filius in Seemann Fl. Vit. (1868) 301.

Phreatia upoluensis Schlechter may be a synonym.

Fiji: *Seemann 589; Smith 1896; Wilkes U. S. South Pacif. Expl. Exped.*

Samoa.

Phreatia vitiensis *Rolfe ex Gibbs* in Journ. Linn. Soc. Bot. 39 (1909) 175.

Fiji: *(Gibbs 619).*

THRIXSPERMUM *Loureiro*

Thrixspermum Graeffei *Reichenbach filius* in Seemann Fl. Vit. (1868) 297.

Fiji: *Wilkes U. S. South Pacif. Expl. Exped.; Prince s.n.; Smith 1808; Parks 20959; Gillespie 3003, 3071.*

Samoa.

GENUS?

Without doubt this genus belongs among the less highly evolved genera of the Sarcanthinae. The flowers of the specimen examined are old, lack pollinia and have the column somewhat distorted; indeed, this specimen belong to a genus quite unknown to me. The structure of the lip is somewhat similar to that of *Cordiglottis* J.J. Sm., but the plant under consideration is quite distinct from that genus.

Fiji: *Gillespie 3307.*

SARCOCHILUS *R. Brown*

Sarcochilus gracilis *Rolfe ex Gibbs* in Journ. Linn. Soc. Bot. 39 (1909) 176.

Fiji: *(Gibbs 727).*

CHRONIOCHILUS *J.J. Smith*

Chroniochilus Godeffroyanum *(Reichb.f.) L.O. Williams comb. nov.*

Thriaspermum Godeffroyanum Reichenbach filius Xen. Orch. 2 (1867) 122; in Seemann Fl. Vit. (1868) 297, t. 90.

Sarcochilus Godeffroyanus Bentham & Hooker filius ex Drake Ill. Fl. Ins. Pacif. (1886) 310.

Chiloschista Godeffroyana Schlechter Orch. Sino-Jap. Prodr. (1919) 275.

This species seems to belong to the genus *Chroniochilus* rather than to any of those genera to which it has been previously referred. The structure of the lip would exclude it from both *Thriaspermum* and *Sarcochilus;* from *Chiloschista* it is distinguished easily by means of the vegetative structure.

Fiji: *Harvey s.n.; Seemann 600.*

SACCOLABIUM *Blume*

There have been eight species of *Saccolabium* described from Polynesia, Micronesia and Melanesia. Six of these species are apparently very closely allied, if one may depend upon published descriptions, in fact so closely allied that specimens at hand cannot be determined from the written descriptions. These species are *Saccolabium Bertholdii* Reichb.f., *S. constrictum* Reichb.f., *S. Graeffei* Reichb.f., *S. Kajewskii* Ames, *S. minus* Reichb.f. and *S. Vaupelii* Schltr. The seventh species, *S. guamensis* Ames, is amply distinct; the eighth species, *S. luteum* Volkens, is not well described yet does not seem to be referable to

any of the above species. The additional species described below is not closely allied to any of the species I have mentioned, but reminds one of *S. tenellum* Ames, a native of the Philippines.

Saccolabium Bertholdii *Reichenbach filius* in Seemann Fl. Vit. (1868) 297.

Fiji: *(Seemann 595; Graeffe).*

Saccolabium constrictum *Reichenbach filius* Otia Bot. Hamb. (1878) 52; Xen. Orch. 3 (1881) 29.

Fiji.

Saccolabium Gillespiei *L. O. Williams sp. nov.*

Herba parva, epiphytica, brevicaulis. Folia lanceolata, acuta, conferta, disticha, apice inaequaliter biloba. Inflorescentia gracilis; bracteae lanceolatae, acutae. Sepalum dorsale oblanceolatum, obtusum, naviculare. Sepala lateralia oblongo-lanceolata, acuta vel obtusa, leviter falcata. Petala oblongo-lanceolata, acuta vel obtusa, leviter falcata. Labellum obscure trilobatum, saccatum; lobus medius rhombico-ovatus; lobi laterales erecti, obscuri; saccus conicus, ecallosus. Columna generis.

A small epiphytic herb, 6–7 cm. tall including the leaves. Stem terete, about 1 cm. long. Leaves lanceolate, acute, crowded, distichous, unequally bilobed at the apex, 1–5 cm. long, 0.3–0.7 cm. broad. Peduncle and inflorescence slender, as long as the leaves or exceeding them in length, 15–20-flowered; bracts lanceolate, acute, reflexed, about 1 mm. long. Dorsal sepal oblanceolate, obtuse, navicular, about 1.5 mm. long and about 0.5 mm. broad. Lateral sepals oblong-lanceolate, acute or obtusish, slightly falcate, about 1.5 mm. long and 0.5 mm. broad. Petals oblong-lanceolate, slightly falcate, oblique and obtuse or acute at the apex, about 1 mm. long and 0.25 mm. broad. Lip obscurely 3-lobed, strongly saccate; mid-lobe

rhombic-ovate, about 0.75 mm. long; lateral lobes inconspicuous, erect; sac inverse-conic, ecallose, about 1 mm. long. Column of the genus.

Saccolabium Gillespiei is not closely allied to any of the species of *Saccolabium* known to be natives of Polynesia. In size and facies it reminds one somewhat of *S. tenellum* Ames, a native of the Philippine Islands.

Fiji: Viti Levu, Namosi Province, vicinity of Namosi. Growing on a tree. At 400 meters altitude. September 5, 1927. *Gillespie 2594;* Viti Levu, Namosi Province, near Namuamua. "Grows in a tree at waterfall." At 400 meters altitude. September 23, 1927. *Gillespie 2991* (Type in Herb. Ames No. 47526).

Saccolabium Graeffei *Reichenbach filius* in Gard. Chron. n.s. 16 (1881) 716.

Fiji: *(Graeffe).*

Saccolabium minus *Reichenbach filius* in Gard. Chron. n.s. 9 (1878) 266.

South Sea Islands (ex Hort. Veitch).

No definite group of islands is given for this species.

SARCANTHUS *Lindley*

Sarcanthus nagarensis *Reichenbach filius* in Seemann Fl. Vit. (1868) 298.

Fiji: *(Seemann 594).*

TAENIOPHYLLUM *Blume*

Taeniophyllum fasciola *(Forst.) Reichenbach filius* in Seemann Fl. Vit. (1868) 296—Rolfe ex Gibbs in Journ. Linn. Soc. Bot. 39 (1909) 176.

Epidendrum fasciola Forster Fl. Ind. Austr. Prodr. (1786) 60.

Limodorum fasciola Swartz in Act. Holm. (1800) 230.

Vanilla fasciola Gaudichaud in Freycinet Voy. Uranie et Physic. Bot. (1826) 427.

Fiji: *(Gibbs 885).*
Guam, Society Islands, Samoa, Tonga Islands.

Taeniophyllum Seemannii *Reichenbach filius* in Seemann Fl. Vit. (1868) 296.

Taeniophyllum fasciola Seemann in Bonpl. 10 (1862) 297, *nomen nudum*, non *Epidendrum fasciola* Forst.

Fiji: *Seemann 593; (Storck 907).*

Taeniophyllum vitiense *L. O. Williams sp. nov.*

Herba parva, epiphytica, acaulescens. Radices planae, uninerviae. Pedunculi filiformes, pubescentes. Inflorescentia disticha, brevis; bracteae ovatae. Sepalum dorsale oblongo-lineare, obtusum, trinervium. Sepala lateralia lineari-lanceolata, obtusa vel acuta, trinervia. Petala lineari-oblonga, trinervia. Labellum sagittatum, apice bicarinatum, acutum, basi serotiformi-saccatum. Columna generis.

A small acaulescent (or semiacaulescent) epiphytic herb. Roots flattened, strongly 1-nerved, mostly less than 15 cm. long, 2–4 mm. broad. Peduncles filiform, short glandular-pubescent, 4–5 cm. long. Rachis short, flexuous. Inflorescence few-flowered, distichous; bracts semipeltate, ovate, obtuse, mostly about 1 mm. apart on the rachis, about 0.75 mm. long. Perianth parts ocellate with crystalline inclusions, slightly fleshy, free to the base. Dorsal sepal oblong-linear, obtuse, 3-nerved, about 3.5 mm. long and 1 mm. broad. Lateral sepals linear-lanceolate, obtuse or acute, 3-nerved, about 3 mm. long and 1 mm. broad. Petals linear-oblong, obtuse, fleshy, 3-nerved, about 3 mm. long and 0.75 mm. broad. Lip sagittate, the apex somewhat bicarinate-thickened, acute, about 3 mm. long and 2.5 mm. broad at the base which is serotiform-saccate, the sac continued directly back from the

blade, about 2 mm. long and 1.5 mm. in diameter. Column short and broad.

Taeniophyllum vitiense seems to be most closely allied to *T. asperulum* Reichb. f., a species described from Tahiti. It may be easily distinguished as follows:

T. asperulum	*T. vitiense*
Peduncle rough, but glabrous.	Peduncle glandular-pubescent.
Lip with a distinct sinus between each lateral lobe and the terminal lobe.	Lip without three lobes, hence devoid of sinuses.

An isotype specimen (or type?) of *T. asperulum* is in the Gray Herbarium, but unfortunately it lacks flowers. In addition to this specimen, a copy of Reichenbach's analytical drawings of the species are in the Ames Herbarium. The peduncle of *T. asperulum* was described by Reichenbach (Otia Bot. Hamb. (1878) 53) as "validis asperis" and the drawing confirms this characterization, but the specimen referred to is faintly if at all asperous.

Smith's number 636 was originally confused with Reichenbach's *T. asperulum* and may be found in herbaria under that name.

FIJI: Vanua Levu, Thakaundrove, southwestern slope of Mount Mbatini. Epiphyte, the "leaves" appressed to tree trunks. Perianth pale yellow. At 300–700 meters altitude. November 28, 1933. *Smith 636* (TYPE in Herb. Ames No. 42133).

A NOTE CONCERNING TWO SOUTH AMERICAN ORCHIDS

BY

LOUIS O. WILLIAMS

Erythrodes platensis *(Hauman) L. O. Williams comb. nov.*

Physurus platensis Hauman in Anal. Mus. Nac. Hist. Nat. Buenos Aires 29 (1917) 370, fig. 5.

This species has appeared in a collection of orchids sent to me recently from Argentina by Dr. Arturo Burkart.

The specimen reported from Paraguay is essentially the same as the ones from Argentina.

PARAGUAY: Near Sapucay. August 1913. *Hassler 11899.*

ARGENTINA: Province of Buenos Aires, Delta del Paraná, Arroyo Pajarito. September 18, 1932. *Burkart 4596;* Ribera del Río de la Plata, Isla Santiago. November 31, 1930. *Cabrera 1505.*

Malaxis Reichenbachiana *(Schltr.) L. O. Williams comb. nov.*

Microstylis Reichenbachiana Schlechter in Fedde Repert. Beihefte 10 (1922) 40.

The specimen referred to below, was sent for determination by Professor Martín Cárdenas of La Paz, Bolivia.

BOLIVIA: Sailapata, Department of Cochabamba. On wet soil in forest. At 2900 meters altitude. November 1935. *Cárdenas 3285.*

EPIDENDRUM PANSAMALAE *Schlechter*

BY

CHARLES SCHWEINFURTH

Epidendrum pansamalae *Schlechter* in Fedde Repert. 10 (1912) 485.

While the type *(Türckheim 1062)* is a native of Guatemala (Pansamala), a Costa Rican specimen recently received is surely conspecific. This specimen would seem to differ from the typical form in several characters. The largest leaves reach a maximum length of 8 cm. and a maximum width of 1.1 cm., whereas the leaves of the type are described as 5–6.5 cm. long and 6.5–8 mm. wide. The lateral sepals have a conspicuous broad median keel toward the apex, a character which is not attributed to the type. The petals are broader than described or as shown in a drawing (in the Ames Herbarium) made under the supervision of Dr. Rudolf Schlechter and are oblong-oblanceolate in outline rather than linear. The apical lobe of the lip is about 9 mm. instead of 6.75 mm. wide. The apices of the basal callus appear to be abruptly truncate and denticulate. The column is slightly shorter than typical.

COSTA RICA: La Fuente. At 1200 meters altitude. "flowers aster purple". November 2, 1925. *A. Alfaro 217* (U. S. Nat. Herb. No. 1315816).

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A NEW FOSSIL GLEICHENIACEOUS FERN FROM ILLINOIS

BY
WILLIAM C. DARRAH

THE ONLY KNOWN GENUS of Paleozoic ferns attributable to the family Gleicheniaceae is *Oligocarpia* Goeppert. The sorus is of the gleicheniaceous type although the complete details of its anatomy are insufficiently known. The genus has been the subject of considerable study because of its great antiquity and significant relationship. *Oligocarpia* is probably exclusively Paleozoic in age but several authors have included Mesozoic species in the genus.

The living Gleicheniaceae include two genera and eighty species. *Gleichenia* has seventy-nine species which are chiefly distributed in tropical regions, and *Stromatopteris*, endemic to New Caledonia, is monotypic. No species of the family occur in the existing north temperate flora.

Sometimes a third genus, *Platyzoma*, is recognized. This genus contains only one species occurring in northern Australia.

The oldest undoubted Gleicheniaceae occur in the Triassic of Switzerland, and soon thereafter the group became widely distributed over the world. It seems probable that the family attained its maximum development during Cretaceous times, and that it has gradually declined since the beginning of the Cenozoic.

Oligocarpia antedates the Triassic and thus is older than any of the typical members of the family. It has been observed that the fructification of *Oligocarpia*, though distinct, bears close resemblance to those fructifications characteristic of the Gleicheniaceae.

Six species of *Oligocarpia* have been reported from Carboniferous rocks of North America: *O. gutbieri* Goeppert, *O. alabamensis* Lesquereux, *O. flagellaris* Lesquereux, *O. missouriensis* D. White, *O. kansasensis* Sellards, and *O. brongniarti* Stur.

In a collection of fossil plants from the Mazon Creek beds recently sent to the Botanical Museum of Harvard University by Mr. F. O. Thompson of Des Moines, Iowa, there are excellent fruiting examples of a typical *Oligocarpia* which cannot be referred to any of the described species. It is noteworthy that Lesquereux labelled similar sterile specimens and one poorly preserved fertile specimen as "*Pecopteris sp. nov.*" I propose to name this species *Oligocarpia vera.*

This new species is especially interesting because each sporangium possesses a uniseriate annulus. Serial transverse sections were made through 20 sori by the nitrocellulose peel method. It was possible to take from 8 to 14 peels per sorus. The etching solution necessary to dissolve the mineral matrix away from the "carbonized" sorus was 5% hydrochloric acid.

OLIGOCARPIA *Goeppert* 1841 Gattungen der Fossile Pflanzen Lief. i, ii; p. 3.

Genotype: *Oligocarpia gutbieri* Goeppert pl. 4. f. 1, 2.

Original generic description: "Frons bipinnata, pinnulis aequalibus. Nervi primarii flexuosi apicem versus in dichotomias soluti, nervi secondarii simplices dichotomive, inferiores simplices ante marginem evanescentes apice sorigeri, superiores dichotomi excurrentes. Sori e

4–5 sporangiis rotundis multiarticulatis compositi."

Original specific description: "Ol. fronde bipinnata, rhachi tenui, pinnis multiiugis, pinnulis ovatis lata basi sessilibus alternis apice rotundatis crenulato-dentatis approximatis, nervo primario flexuoso sub apice pluries dichotomo, nervis secundariis simplicibus dichotomisve."

The present usage of *Oligocarpia* is that of Kidston[1] whose definition is based chiefly upon *Oligocarpia gutbieri*.

Kidston describes *Oligocarpia* as follows: "Synangia circular, formed of 3 to 5 (rarely 6) pyriform sporangia with a prominent annulus composed of two rows of cells, which passes over the apex of the sporangia and bends down the sides of their free portion. A band of small narrow cells forming a stomium passes down the ventral surface of the sporangia and indicates the part at which the sporangia opened for the dehiscence of the spores. Spores tetrahedrally developed, smooth, with a triradiate ridge on their surface. The synangia are placed singly on the lateral veinlets, and frequently occupy almost the whole of the limb between the midvein and the margin of the somewhat reduced pinnule, or are situated somewhat more to the margin. The veinlet on which the synangia are placed does not extend beyond them."

It will be observed that this diagnosis is in part unsatisfactory.

Oligocarpia vera *Darrah sp. nov.* 5 figures.

Frond probably large, tripinnatifid (quadripinnatifid?); foliage pecopteroid; rachis smooth, occasionally minutely punctate; primary pinnae unknown; "secondary" pinnae alternate, oblique, departing at an angle of 60 degrees. Pinnules ovate, alternate, close, short and robust; apex obtuse, rounded. Pinnules thin, nervation distinct. Veins fork at a wide angle and traverse the lamina in a flexuous

EXPLANATION OF THE ILLUSTRATION

OLIGOCARPIA VERA *Darrah*. Counterparts of the type specimen. The small sori, which are incrusted with calcite, are borne upon typical pecopteroid foliage. Natural size. Carboniferous: Allegheny: Mazon Creek, Illinois. F.O.Thompson Collection.

path. Sori large, placed at the ends of the veins, on the lower surface of the frond. Sporangia 4 to 6 in number, independent, placed in a ring. Sporangia annulate with the annulus composed of one row of cells. Sporangia 35-45 mm. long, 20 mm. wide. Spores numerous (hundreds), subspherical, smooth, 35–40 μ. in diameter.

Holotype No. 18704 F. O. Thompson Collection in the Botanical Museum of Harvard University.

This new species is clearly referable to the group of *Oligocarpia gutbieri*, but is readily distinguished by having a uniseriate annulus and by having robust pecopteroid foliage.

Oligocarpia vera is distinguished from *O. kansasensis* Sellards[2] by its greater size, its pecopteroid rather than sphenopteroid foliage, its smooth rather than punctate rachis, its absence of "thorns" on the rachis, and in not having the tertiary pinnules overlapping. In *O. kansasensis* the details of the sorus are not known. The Kansas species occurs in the Lawrence Shales, Douglas Formation.

Oligocarpia vera differs from *O. alabamensis* Lesquereux in having well developed terminal pinnules, pecopteroid instead of sphenopteroid foliage, and more flexuous venation. It differs also from *O. missouriensis* D. White[4] in having pecopteroid foliage, much greater size, pinnules which are not crenulate and do not depart at right angles from the rachis of the pinna. In *O. missouriensis* the details of the sori and sporangia are not known.

Oligocarpia flagellaris Lesquereux[5] has sphenopteroid foliage and perhaps should be excluded from this genus. Specimen No. 7596 from Morris, Illinois (Lesquereux's No. P.294) is a *Sphenopteris* and the fructification is indistinct. *O. vera* bears no relationship to this species.

It now appears to be clear that the foliage of *Oligo-*

carpia is usually of the sphenopteroid type and frequently investigators, in discussing the genus, fail to consider the fact that the foliage may be pecopteroid.

The chief species of the sphenopteroid series is *Oligocarpia brongniarti* Stur[6] and the best known of the pecopteroid series is *O. gutbieri* Goeppert,[7] although even in this species the foliage is more or less sphenopteroid.

In all of the species in which the sporangia are known, there has been observed a more or less transverse annulus which resembles in great detail that found in the genus *Gleichenia*. There is some evidence indicating that, at least in a few species, the sorus is synangial, even though each sporangium is annulate. In all of the species the sorus is circular and consists of 3–6 (10) pyriform sporangia which Zeiller describes as bearing a complete transverse annulus.

Stur[8] believed that the "annulus" is merely a type of preservation of the exannulate sporangia. Solms-Laubach[9] agreed with the opinion of Stur and went further in saying, "I am still obliged to assent to Stur's opinion of the independent existence of the annulus. If we look at the obliquely conical sporangium from above, we get a profile view of one or more transverse rows of the strongly thickened cell-walls, and may mistake them for an annulus: but we find that whenever we alter the position of a detached sporangium, the supposed annulus appears in another place."

This annulus is not clearly understood. Kidston found that the annulus may be biseriate or triseriate, although earlier work indicated that the annulus was uniseriate. It has been implied that if Kidston's observations prove to be typical for most (if not all) species of *Oligocarpia* then their affinity with the Gleicheniaceae may be challenged. However, it is to be observed that in only a few species of *Oligocarpia* is the sorus known and Kidston's

opinion is practically limited to *O.gutbieri*. It does not follow that the case for or against the existence of the Paleozoic Gleicheniaceae rests on this point.

Synangia do occur occasionally in the living genus *Gleichenia*. In other words, the teratological occurrence of a biseriate annulus and a synangial condition of the sorus in *Gleichenia* admit the possibility and propriety of including *Oligocarpia* in the Gleicheniaceae.

The sorus of *Oligocarpia* may be compared with several types of fructifications attributed to marattiaceous ferns. A case in point is *Asterotheca* notably *Asterotheca miltoni (Artis)*. *Asterotheca* belongs to the Carboniferous eusporangiate complex which can be referred to the Marattiaceae or to a closely allied family. This similarity may indicate phylogenetical relationship. Bower has suggested that the type of sorus in *Gleichenia* is essentially like that of the Marattiaceae—that is, derived from it.

Thus there are two relationships of the sorus which are in doubt. If Kidston is correct in regarding the sorus to be an annulate synangium, then we observe a type of fructification which, as far as I am aware, is not normally found in any existing ferns. On the other hand, if there are species of the genus which have a uniseriate annulus and in which the sporangia are free, then there is no reason for excluding *Oligocarpia* from the Gleicheniaceae.

The Gleicheniaceae are a decadent group which represent but a small remnant of a former diverse stock. It is to be expected that the earlier members of the group fail to conform to the narrow limits of the residual stock which has lost much of its plasticity.

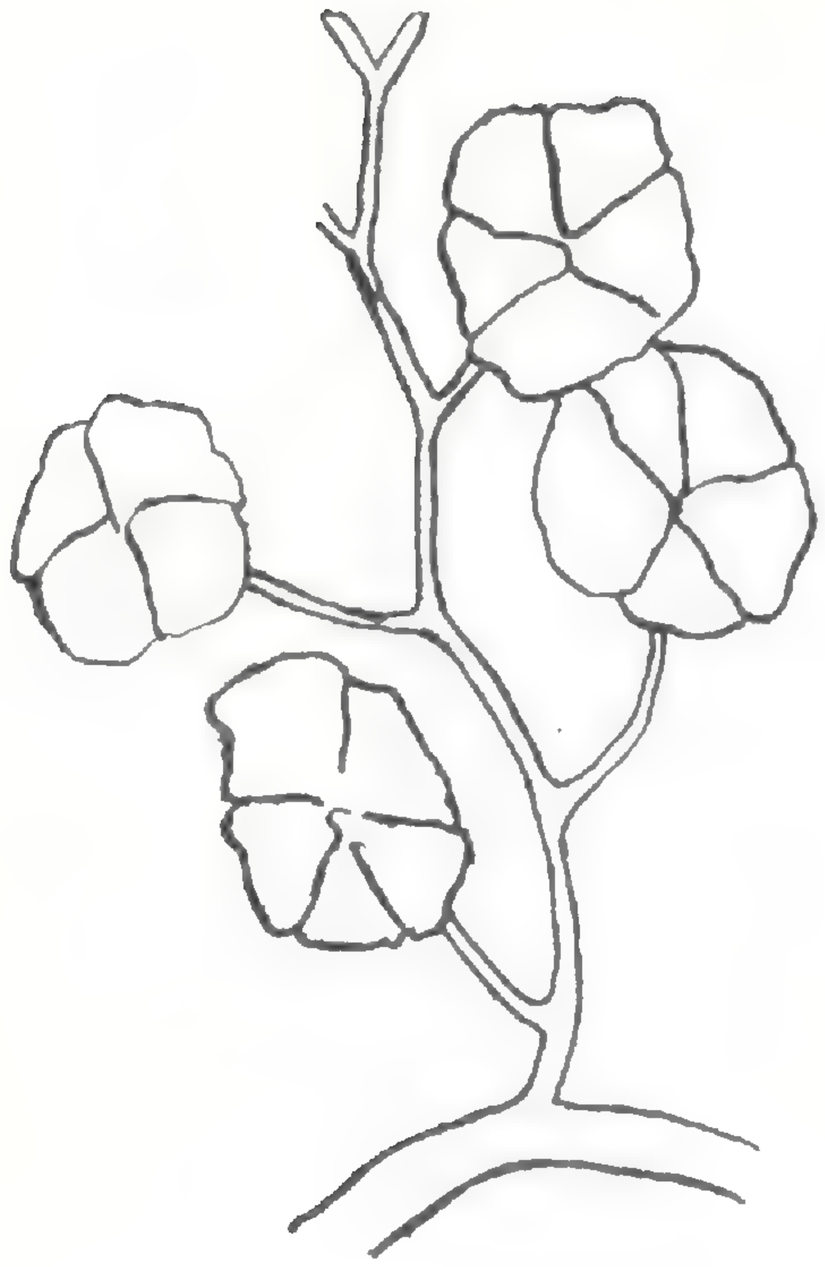
Nevertheless among the comparatively few existing members of the family we encounter several remarkable characters of variability. The sori of the Gleicheniaceae are superficial and are borne in a single row on both sides of the midrib. The number of sporangia in a sorus varies

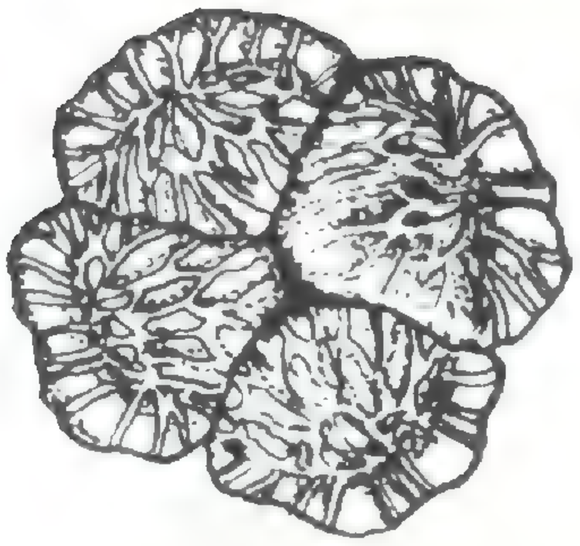
EXPLANATION OF THE ILLUSTRATION

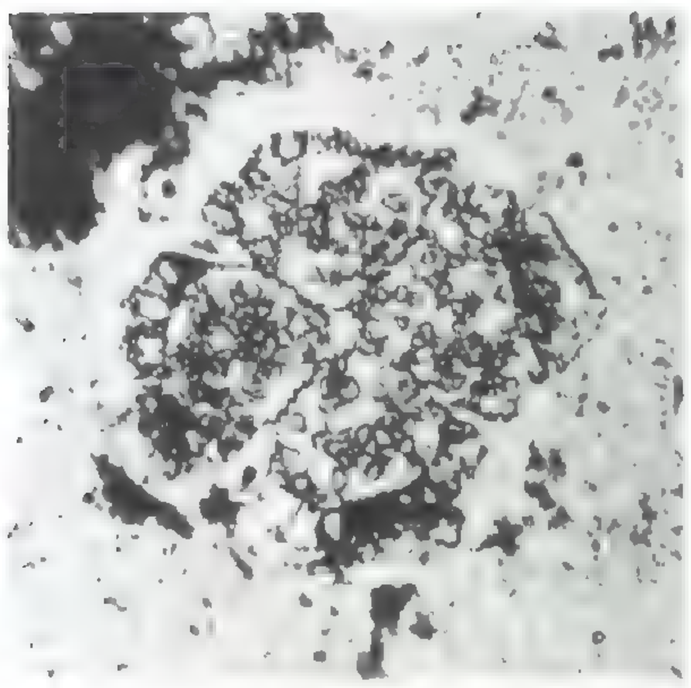
OLIGOCARPIA VERA *Darrah*. The figure at top shows how the sporangia are borne at the ends of secondary veins. Drawn ten times natural size. The lamina is not indicated. The figure in middle is redrawn from Stur. It shows a sorus composed of four sporangia. Twenty times natural size.

Both drawings executed by G. W. DILLON

The figure at bottom is a photograph of a nitrocellulose peel made from the type specimen. It shows four annulate sporangia filled with the subspherical spores. Fifteen times natural size.







from 2 to 6 in most of the species, but in a few the number may be 10 or even 12. There is considerable variation on a single fertile segment. There is no indusium and the sorus is naked. Bower[10] remarks that in the extreme cases of the gleicheniaceous sorus, with a large number of sporangia some of which are displaced by pressure, we find a condition which suggests the sori of both the Marattiaceae and the Cyatheaceae. In the former, the typical sorus is a single row of sporangia which surrounds a low receptacle. In the latter, the receptacle is elongated and its apex is covered with sporangia. In the eusporangiate Marattiaceae the spore-output is generally very large and in the higher ferns the spore-output is usually smaller. In the comprehensive genus *Gleichenia* it has been observed that the spore-output varies from 128 to 1024 and the number 256 is most frequent. *Stromatopteris*, on the basis of several spore counts, has a potential output of 512. *Platyzoma* is particularly important in this connection, because it exhibits a condition which is considered as incipient heterospory. The sporangia are of two sizes, the smaller of which are more abundant. The number of spores varies from 16 downward in the larger sporangia, and from 32 downward in the smaller sporangia (Bower). There are intergrades between the extremes.

This heterogeneous complex probably represents several relict lines of descent from a more extensive group, and the morphology of the spore-bearing members makes this suggestion more probable.

It is advisable to append to this dicussion a few additional observations, though they are included only for the sake of completeness.

Oligocarpia brongniarti Stur was believed by Zeiller[11] to have a uniseriate annulus, but recently De Pape and Carpentier[12] have figured a specimen which indicates that the annulus of the sporangium may be biseriate.

Some years ago Stopes[13] recognized that Dawson's *Sphenopteris splendens*[14] was identical with *Oligocarpia brongniarti* Stur[15] and that Dawson's specific name held priority. Consequently, the species was renamed *Oligocarpia splendens*. Kidston, however, rejected this new name and retained the name given by Stur, because the figures published by Dawson are of no value. This is the usual procedure adopted by paleobotanists. The New Brunswick plant, then, is known as *O. brongniarti*.

Most of the species of *Oligocarpia* are of upper Carboniferous age. The rocks of the Pennsylvanian formations of northern Illinois have yielded three species in addition to *O. vera*. A fourth, *Oligocarpia flagellaris* Lesquereux, is to be excluded from this genus; it is better known as *Sphenopteris flagellaris* Lesquereux. The reference of this species to the form-genus *Sphenopteris* restores to validity the original name used by Lesquereux in the *Journal of the Boston Society of Natural History* in 1854 (volume 6, page 420) and in the *Geology of Pennsylvania* in 1858 (page 862). In the *Coal Flora* (page 267), Lesquereux remarked that the habitat is "South Salem Vein, Tunnel of Sharp Mountain, near Pottsville" [Pennsylvania] and "no other specimens have been found than the one figured." This statement was erroneous, for according to Lesquereux's manuscript catalogue, he had referred specimens from Illinois, West Virginia, and western Pennsylvania to this species.

Lesquereux reported a specimen of *Oligocarpia alabamensis* from Morris, Illinois, but this record is in error. David White[16] suggested that it should have been renamed and that the specimen belonged rather to *O. missouriensis*. I have seen no specimen from Illinois referable to either *O. alabamensis* or *O. missouriensis*. Tentatively, I record the occurrence of the latter species from Illinois on the strength of White's remarks.

Lesquereux also recorded *Oligocarpia cf. gutbieri* from Mazon Creek. White was doubtful of the accuracy of Lesquereux's determination, but I do not share this doubt. I have seen six specimens referable to this species all from Braidwood and Mazon Creek. My concept of *O.gutbieri* is based entirely upon the descriptions published in western Europe, although I have relied chiefly upon the opinions of Stur and Kidston.

In summarizing, it is observed that only two undoubted species of *Oligocarpia* occur in the Mazon Creek flora of Illinois: *O.gutbieri* Goeppert, and *O.vera* Darrah which is described in this paper. It is possible that *O.missouriensis* D.White also occurs in this region, but the record is questionable. The record of *O.alabamensis* Lesquereux is erroneous.

Oligocarpia vera is one of the pecopteroid species of *Oligocarpia* and is remarkable for its uniseriate annulus. The evidence regarding the systematic position of the genus is here reviewed and it is concluded that it belongs properly to the existing family Gleicheniaceae.

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CASTILLA OR CASTILLOA?

BY
ALBERT F. HILL

IN A RECENT BOOK REVIEW, Dr. A. B. Rendle[9] commented on the use of the generic name *Castilla* for the Panama or Central American Rubber Tree, pointing out that it should be *Castilloa*. Although the question as to the correct name for this genus has been discussed in the past by Cook[5], Pittier[7] and others, it may be worth while to restate the essential facts.

In 1793, Vicente Cervantes delivered a lecture on botany at the Real Jardín Botánico in Mexico City during the course of which he described the rubber tree of Mexico and Central America and proposed for it the name *Castilla elastica*. The following year (1794), the text of Cervantes' lecture was published[4] in a Suplemento á la Gazeta de Literatura de Mexico, together with a figure of *Castilla elastica*. The generic name was chosen to commemorate Juan Diego del Castillo (1744-1793), a Spanish pharmacist and economic botanist, whose death occurred while he was compiling a flora of Mexico.

In 1805, with a view to rendering more accessible various botanical articles which had appeared in obscure journals, Charles Koenig[6] of the British Museum published translations of nine rare or little known contributions. Among these was Cervantes' article. In the translation, however, the generic name was altered to *Castilloa*.

Although Koenig gave no reason for the change, the extra vowel was in all probability introduced in order to make the name grammatically correct, and was not the result, as Pittier states, of a typographical error, "a slip of the pen or the officious but ignorant interference of the translator."

Whatever the reason for the change, the name *Castilloa* became firmly established in literature, and its use was continued unquestioned for nearly a hundred years.

In 1903, however, O. F. Cook[5] (in his memoir on the Central American Rubber Tree) pointed out that the use of *Castilloa* for the genus could be "justified by no recognized rule of botanical nomenclature." Pittier[7], who monographed the genus in 1910, concurred in this opinion. Certainly there have been no recent changes in the laws of priority or other rules of nomenclature that would make the use of *Castilloa* any more permissible at the present time.

In America at least, *Castilla* is quite generally considered to be the name which must be taken up for this genus, even though *Castilloa* may be grammatically correct. As evidence of this, recent publications of such authorities as Bailey[1], Britton and Wilson[2], Record and Mell[8], and Standley[10,11,12,13] may be cited. There is evidence also that taxonomists in other parts of the world are reverting to the older name. Burkill[3], for example, uses *Castilla* and comments briefly on the "mischance" which was responsible for the adoption of *Castilloa*.

Although over thirty years have elapsed since Cook pointed out that *Castilla* was the correct name for the rubber trees of Central America and Mexico, it is not at all surprising that most of the literature on economic botany continues to use the more familiar *Castilloa*. It is strange, however, that the competent taxonomists in England and on the continent continue to condone the

use of a name that is contrary to the established rules of botanical nomenclature.

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ORCHID STUDIES, V

BY

LOUIS O. WILLIAMS

THROUGH THE KINDNESS of Dr. William R. Maxon, Curator of the United States National Herbarium, the orchids collected by Joseph F. Rock in Yunnan Province, China, and adjacent Burma in 1922-1923 have been made available for study. The collection contains 157 numbers of orchids, many of which are of unusual interest. In addition to the two species described below, there are several others which possibly will prove to be new when more critical studies and comparisons can be made.

In addition to the collection of Chinese orchids mentioned above, an interesting Philippine species of Taeniophyllum (which belongs to the genus segregated by Dr. Rudolf Schlechter as Geissanthera) has made the study of several allied species necessary. This species and its allies are discussed, and an additional Philippine species of Taeniophyllum (subgenus Eutaeniophyllum) is described.

Orchis constricta *L. O. Williams sp. nov.*

Herba parva, terrestris, 4–8 cm. vel ultra alta. Folia duo, basalaria, late elliptica, acuta vel acuminata, basi leviter petiolata. Bracteae inflorescentiae lineari-lanceolatae, acutae. Inflorescentia uniflora. Sepalum dorsale rhombico-lanceolatum, obtusum, leviter navieulare, trinervium. Sepala lateralia late lanceolata, obtusa, falcata, obliqua, trinervia. Petala lineari-lanceolata, obtusa vel acuta, binervia. Labellum trilobatum; lobi laterales basi labelli, lineari-lanceolati, acuti; lobus medius rhombicus, obscure crenulatus vel integer: calcar elongatum, curvatum, prope apicem constrictum.

A small terrestrial herb 4–8 cm. or more tall. Tubers

probably fusiform, about 1 cm. long. Scape filiform, not greatly exceeding the leaves in length. Leaves two, basal, broadly elliptic, acute or acuminate, tapering into a short petiole at the base, 2–5 cm. long, 0.8–2 cm. broad, probably becoming longer when mature. Inflorescence 1-flowered. Floral bract linear-lanceolate, acute or acuminate, 6–12 mm. long, 1–3 mm. broad. Dorsal sepal rhombic-lanceolate, obtuse, slightly navicular, 3-nerved, about 8 mm. long and 4 mm. broad. Lateral sepals broadly lanceolate, obtuse, falcate and somewhat asymmetrical, 3-nerved, about 8 mm. long and 4 mm. broad. Petals linear-lanceolate, obtuse or acute, 2-nerved, about 6 mm. long and 1.5 mm. broad. Lip 3-lobed: lateral lobes linear-lanceolate, acute, from the base of the lip about 7 mm. long and 1.5 mm. broad: mid-lobe rhombic, obtuse, obscurely crenulate or entire, about 10 mm. long and 6 mm. broad; spur very long and strongly curved toward the apex, probably somewhat flattened laterally, constricted near the apex, enlarged and saccate at the apex, 22–30 mm. long, with its throat 3–5 mm. in diameter, its constriction 1–2.5 mm. in diameter, and its saccate portion about 5 mm. long and 3–4 mm. in diameter.

Orchis constricta is not closely allied to any other species of Orchis known to the author. The following characters serve to distinguish the species: the one-flowered inflorescence, the very long curved spur which is constricted near the apex and the comparatively large size of the flower.

China: Yunnan Province Wua chje, 3 days north of Muli, Yangtze watershed, Prefectural District of Likiang, eastern slope of Likiang Snow Range. In forest, flowers purple. May-October 1922. *Rock 5592* (Type in Herb. Ames No. 46474).

Oberonia latipetala *L. O. Williams sp. nov.*

Herba parva, epiphytica, usque ad 12 cm. alta. Folia

equitantia, lanceolata, acuta vel acuminata, coriacea. Bracteae inflorescentiae aristatae, basi ovatae. Inflorescentia spicata cum floribus confertis. Sepalum dorsale oblongo-lanceolatum, obtusum, sine nervum, dorso paulo echinatum. Sepala lateralia sepalo dorsali similia. Petala ovalia, obtusa, trinervia, minute ciliata. Labellum simplex, obovatum, infra medium constrictum, basi auriculatum, apiculatum, ciliatum et supra pubescens.

A small epiphytic herb, up to about 12 cm. tall. Roots few, small, glabrous or possibly somewhat pubescent. Leaves equitant, lanceolate, acute or acuminate, coriaceous, 1.5–5 cm. long, 0.3–0.7 cm. broad. Inflorescence spicate, many-flowered, dense. Floral bracts ovate-lanceolate, the upper ones acuminate, the lower ones becoming smaller and long-aristate. Dorsal sepal oblong-lanceolate, obtuse, without nerves, minutely echinate dorsally, about 2 mm. long and 1 mm. broad. Lateral sepals similar to the dorsal sepal. Petals oval, obtuse, 3-nerved, minutely ciliate, 2–2.5 mm. long, 1.5–2 mm. broad. Lip simple, obovate, somewhat constricted below the middle and inconspicuously auriculate at the base, short-apiculate at the apex, 3-nerved with the median nerve often obscure, ciliate, finely pubescent on the upper surface, 1–1.5 mm. long, 0.75–1.25 mm. broad. Column about 0.5 mm. long.

Oberonia latipetala is not closely allied to any species known to occur in China or India. It may be distinguished by the very broad petals, by the sepals which are minutely echinate dorsally and by the simple lip which is slightly auriculate at the base and somewhat constricted below the middle.

China: Yunnan Province, camp at Ya Tau Pa, between Tengyueh and Lungling. Epiphyte, flowers greenish. October 21, 1922. *Rock 7117* (Type in Herb. Ames No. 46475).

TAENIOPHYLLUM *Blume*

Taeniophyllum is one of those perplexing genera of orchids of which the collector usually finds but a few plants. The flowers are delicate and apparently never produced abundantly; hence material finding its way into herbaria is often indeterminable.

In the Philippine Islands the genus is represented by six described species. The author believes that this number might be doubled, for there are specimens in the Ames Herbarium which seem to indicate that there may be an equal number of undescribed species in the Philippines. The material at hand is adequate for the description of two of these species, but it is thought advisable to await more complete material before attempting to identify the others.

The species of *Taeniophyllum* previously known to be natives of the Philippines have all belonged to the subgenera *Eutaeniophyllum* and *Microtatorchis*. Another subgenus is proposed, to which a new Philippine species and two old species are referred.

TAENIOPHYLLUM subg. **Geissanthera** *(Schltr.) L. O. Williams comb. nov.*

Geissanthera Schltr. in Schumann & Lauterbach Nachtr. Fl. Deutsch. Schutzgeb. (1905) 231, t. 12 B—J.J.Sm. Nova Guinea 8 (1909) Orch. 129.

Taeniophyllum (subg. Geissanthera) **papuanum** *(Schltr.) L.O.Williams comb. nov.*

Geissanthera papuana Schltr. in Schumann & Lauterbach Nachtr. Fl. Deutsch. Schutzgeb. (1905) 232.

Taeniophyllum (subg. Geissanthera) **tubulosum** *(J.J.Sm.) L.O.Williams comb. nov.*

Geissanthera tubulosa J.J.Sm. in Bull. Dépt. Agric.

Ind. Néerl. No. 19 (1908) 24—J.J.Sm. Nova Guinea 8 (1909) Orch. 129, t. 44.

Taeniophyllum (subg. Geissanthera) **bracteatum** *L.O.Williams sp. nov.*

Herba parva, epiphytica, usque ad 4 cm. alta. Folia parva, basalaria, oblongo-lanceolata, cum mucrone aristato longo. Pedunculus leviter fractiflexus, cum bracteis a basi usque ad apicem. Bracteae basi cum stipularum aristatarum paribus, foliis similes. Sepala lanceolata, acuta. Petala sepalis similia sed paulo angustiora. Labellum lanceolatum, acutum, basi dilatatum, parte dilatata lobos laterales formanti. Columna subgeneris.

A small acaulescent (or semiacaulescent) epiphytic herb, about 4 cm. tall. Roots apparently somewhat flattened, those seen not longer than the stem and inflorescence. Leaves basal, small, lanceolate, with a long aristate mucro, 10 mm. or less long, about 2 mm. broad, the mucro 1–2 mm. long. Pedunele slightly fractiflex, strongly bracteate to the base. Bracts oblong-lanceolate, mucronate, about 3–9 mm. long; with a pair of aristate, basal, stipule-like processes. Sepals lanceolate, acute, about 3 mm. long and 0.75 mm. broad. Petals similar to the sepals but slightly narrower. Lip lanceolate, acute, about 3 mm. long, dilated toward the base, the dilated portion forming the lateral lobes which are normally erect or infolded. Spur scrotiform, about 1–1.5 mm. long.

Taeniophyllum bracteatum is most closely allied to *T. papuanum* from which it may be easily distinguished as follows:

T. bracteatum	*T. papuanum*
Perianth parts about 3 mm. long.	Perianth parts about 6 mm. long.
Sepals and petals acute.	Sepals and petals acuminate.
Lip subsimple, merely broadened at the base.	Lip not simple, with two lateral teeth.

PHILIPPINE ISLANDS: Negros, Canlaon Volcano. April 1910. *Merrill 7010* (TYPE in Herb. Ames No. 11839).

Taeniophyllum (subg. Eutaeniophyllum) **saccatum** *L. O. Williams sp. nov.*

Herba parva, epiphytica, acaulescens. Pedunculus filiformis, papillifer. Bracteae inflorescentiae lanceolatae. Sepalum dorsale lineari-lanceolatum, acutum, uninervium, leviter carinatum. Sepala lateralia acuta vel obtusa. Petala lanceolata, acuta, uninervia. Labellum lanceolatum, prope apicem cum callo donatum, basi saccata; lobi laterales rotundi.

A small epiphytic acaulescent herb. Roots flattened, strongly 1-nerved, 2–3 mm. broad, mostly less than 10 cm. long. Peduncle filiform, papilliferous, fractiflex, commonly less than 7 mm. long. Bracts of the inflorescence lanceolate, usually about 2 mm. apart, about 1 mm. long. Perianth parts ocellate with crystalline inclusions, more or less fleshy, the sepals and petals adnate at the base for a short distance. Dorsal sepal linear-lanceolate, acute, 1-nerved, about 3 mm. long and 0.75 mm. broad. Lateral sepals lanceolate, acute or obtuse, 3–3.5 mm. long and 0.75–1 mm. broad. Petals lanceolate, acute, 1-nerved, about 2.5 mm. long and 1 mm. broad. Lip 3-lobed, broadly lanceolate, about 3.5 mm. long, with a thickening or callus near the apex; lateral lobes inconspicuous, rounded, not separated from the mid-lobe by a sinus; at the base of the lip there is a large saccate spur which is strongly constricted at the neck, is directed forward, and is about 3.5 mm. long and 1.5 mm. in diameter. Column short, with a pair of oblong-ovate stelidia; rostellum bifid.

Taeniophyllum saccatum is most easily distinguished from all of the other known Philippine species by the much enlarged saccate portion of the spur. The species most closely allied to it seems to be *T. Elmeri*, which is

similar in the form of the inflorescence and in facies, but the structure of the lip together with the saccate spur serves to differentiate the two species.

PHILIPPINE ISLANDS, Leyte: Jaro, Buenavista. Epiphyte. At 500 meters altitude. March 15, 1914. *Wenzel 352;* Jaro, Masaganap. Epiphyte in forest. At 750 meters altitude. February 11, 1914. *Wenzel 265;* Jaro, Masaganap. Epiphyte in forest. At 600 meters altitude. March 9, 1914. *Wenzel 337;* November 20, 1914. *Wenzel 687;* Jaro, Masaganap. Forest. At 600 meters altitude. November 16, 1914. *Wenzel 669;* Jaro, Masaganap. Epiphyte in forest. At 600 meters altitude. November 22-23, 1914. *Wenzel 711;* Jaro, Masaganap. Forest. At 700 meters altitude. February 19, 1915. *Wenzel 885* (TYPE in Herb. Ames No. 44135); Jaro, Masaganap. Epiphyte in forest. At 700 meters altitude. March 2, 1915. *Wenzel 895.*

CORALLORRHIZA STRIATA *Lindley*, A MIXTURE

BY

LOUIS O. WILLIAMS

IN STUDYING THE ORIGINAL DESCRIPTION of *Corallorrhiza striata* Lindley (Gen. & Sp. Orch. Pl. (1840) 534), it was found to disagree with the interpretation generally given the species by American authors. *C. striata* was described as having a trilobulate lip, a character which is unknown in *C.striata* as commonly understood.

Lindley's type specimen is a mixture of *C.striata*, as that species is usually interpreted, with another species of Corallorrhiza, very probably *C.maculata* Raf. Fortunately there is a good photograph of the type specimen in the Ames Herbarium. This photograph of the Lindley type shows parts of three plants collected by Douglas in "N.W.America" and a sketch (by Lindley) of a flower and lip. Only the left hand inflorescence is referable to *C.striata* in its present accepted sense, and is the only material having striate flowers. Consequently this material should be accepted as the true type of Lindley's *C.striata*, in spite of the discrepancies written into the original description.

A probable duplicate of the Douglas collection, on which Lindley's species is based, is to be found in the Gray Herbarium: it is *C.striata* of traditional usage.

If we consider the technical characters of Lindley's description, the sketch of the flower which he made and the fact that most of the material upon which he based the species is probably *C.maculata*, one might feel justified in reducing it to synonymy under *C.maculata*. There are, however, several considerations which argue for the retention of the name *C.striata* in the traditional usage:

1. The name *striata* must have been taken from that

part of the type which had striate perianth parts, hence the name would not apply well to *C. maculata*.
2. The name is well established in botanical literature and there has been little or no confusion in its application.
3. The type sheet bears a specimen of *C. striata* and the description applies to that specimen, in major part.
4. To take up another name for the plant would cause confusion and serve no useful purpose.

It is suggested, therefore, that the use of the name *C. striata* Lindl. be continued in the traditional sense. Toward this end it is proposed that the specimen on the left side of Lindley's type sheet be considered as the type and that the other specimens and the sketch on the sheet be disregarded in the typification of the species.

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THE OCCURRENCE OF THE GENUS TINGIA IN TEXAS

BY

WILLIAM C. DARRAH

THE GENUS TINGIA is one of the unusual late Paleozoic plant-concepts which was formerly referred to the cycads, but is now considered as being a pteridophytic alliance belonging to the Noeggerathiales. Hitherto the genus Tingia has been found only in China and Korea.

In the course of the past four years the Department of Vertebrate Paleontology of the Museum of Comparative Zoölogy of Harvard University has sent expeditions to Texas and New Mexico in quest of Permocarboniferous vertebrates. During field work, representative collections of fossil plants were gathered in more than thirty localities. Among these collections, transmitted to the Botanical Museum for study, is a remarkable florule from Brazos River, Baylor County, Texas, which contains rather lush plants such as are believed to have lived in more or less moist situations. Prominent among these plants is *Tingia*, which is represented by two new species.

Tingia was described by Halle in 1925[1], but in 1927[2] he published an emended description. The emended description is as follows:

TINGIA Halle Paleontologica Sinica ser. A. vol. 2. p. 231, 1927.

"Dorsiventral, frond-like, anisophyllous shoots with

a thick axis. Leaves arranged in four rows, two on the upper and two on the lower side of the axis. Leaves of the two rows on the upper side large, spread out in one plane and forming a rather open angle with the axis, those of the rows on the lower side smaller, directed forward at narrow angles or parallel to the axis. Leaves on the upper side varying from broadly obcuneate-obovate to oblong or linear, with entire lateral margins but more or less deeply lobed at the apex. Leaves of the lower side of more or less similar shape but often narrower or more deeply dissected. Several veins entering each leaf, dichotomizing mostly in the lower part of the leaf, all branches continuing to the apex."

Halle described *Tingia* as bearing four rows of leaflets, two of which may be called normal. The additional rows are composed of smaller leaflets, which are partially hidden by the normal ones. The result is an apparently once-pinnatifid frond. In other words, this structure is an axis bearing true leaves, not a leaf-rhachis. Halle compared this condition to the plagiotropic shoots of *Selaginella* and *Lycopodium*, but Nemeje[3] noted that it is very probable that their growth was limited as for instance in the plagiotropic shoots of the Taxodiae (p. 112).

Halle refrained from referring *Tingia* to the cycads, although its closest relative, *Plagiozamites*, was long considered to be the foliage of some cycadeoid. More recently Nemeje (loc. cit.) recognized the affinities between these two genera and *Noeggerathia* Stur. He proposed the name NOEGGERATHIALES to include all three. In his opinion, this "order" is coördinate with Psilophytales, Psilotales, Lycopodiales, Cladoxylales, Articulatales [Equisetales and Sphenophyllales], and Filicales. The group is characterized as follows (loc. cit. p. 114): "Leaves simple (--at least never pinnate—) pseudomacrophyllous, with radiating and dichotomously dividing nervation.

Axis non-articulated. Sporangia with a tendency to serial and collateral arrangement, sitting on the adaxial side of the sporophylls. Sporophylls composing cone-like fructifications."

In a later paper[4], Nemejc described the typical heterosporous pteridophytic spores of *Noeggerathia foliosa* Sternberg.

Modern plant morphologists recognize three phyletic lines among the vascular plants: Lycopsida, Sphenopsida, and Pteropsida, which presumably trace their common origin to the Devonian Psilophytales or Psilopsida. Jeffrey[5] more than thirty years ago proposed two groups, Lycopsida and Pteropsida. The Lycopsida are microphyllous with adaxial sporangia and the Pteropsida are megaphyllous with abaxial sporangia. Scott[6] distinguished two groups of microphyllous plants, the Lycopsida and Sphenopsida. The Lycopsida have spirally arranged leaves and non-articulated axes, while the Sphenopsida have articulated axes and whorled leaves. The Sphenopsida include chiefly, the Equisetales, the Calamitales, and the Sphenophyllales.

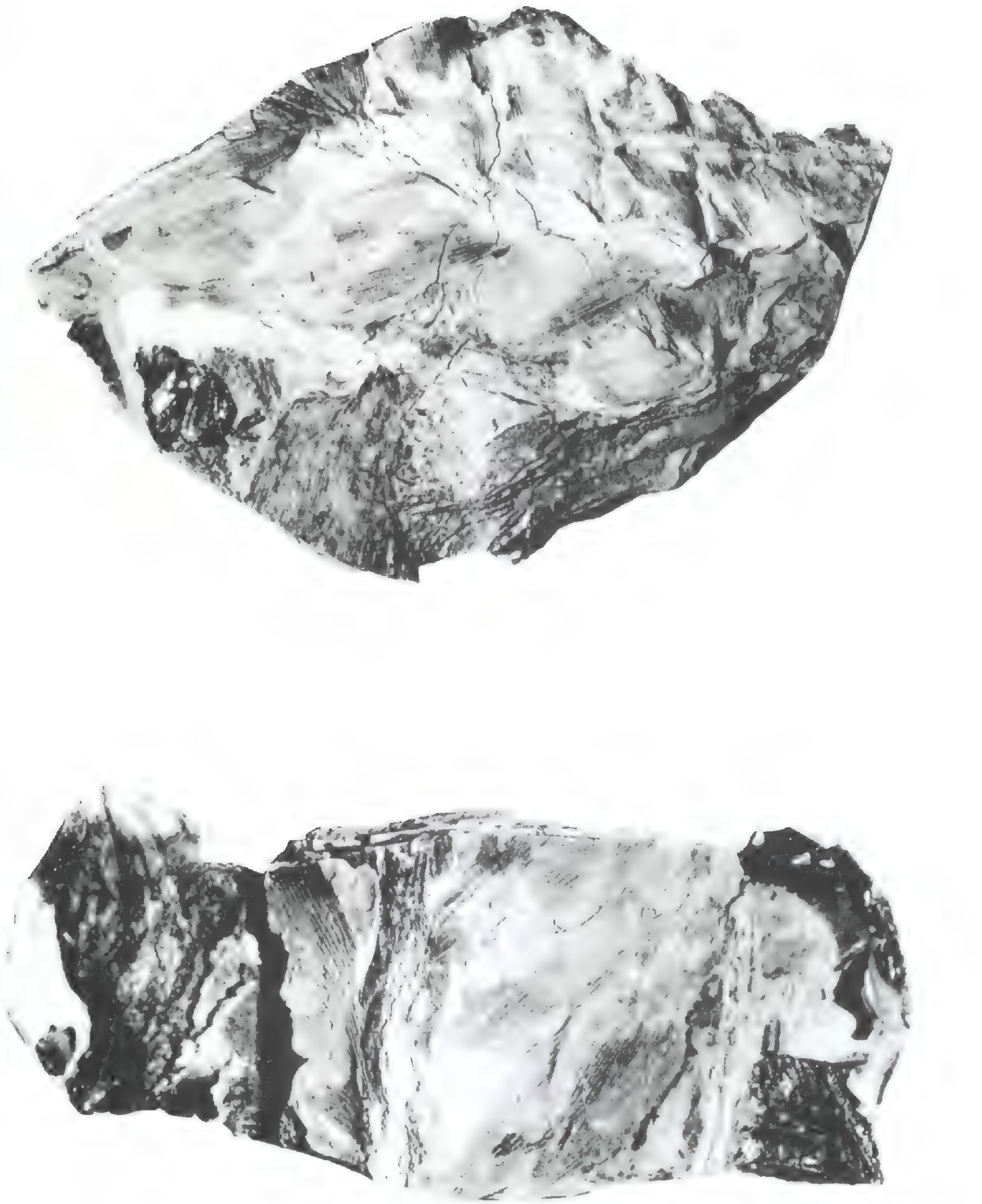
Fructifications of three species of *Noeggerathia* and one attributed to *Tingia* (*Tingiostrobus tetralocularis* Kon'no) have been described.

Lady Isabel Browne has considered this problem from its broader point of view. She concluded that these fructifications belonging to the Noeggerathiales find their closest affinity with the Sphenophyllales. Kon'no[8] considered that they bear closer relationship to the Lycopodiaceae, while Nemejc insisted that they are quite distinct. Lady Browne compared the sporangia of the Noeggerathiales with those of *Sphenophyllum dawsoni* Williamson. In short, she regarded the Noeggerathiales as having simple pseudo-macrophyllous leaves, non-articulated axes, phyllotaxy non-verticillate, and the fructi-

EXPLANATION OF THE ILLUSTRATION

TINGIA TAENIATA *Darrah sp. nov.* Figure at top. The specimen shows the upper part of the axis bearing anisophyllous leaves. Four fifths natural size. Figure at bottom. The specimen shows the stout axis and several linear leaves. The mode of departure of the leaves can be observed on the leaf on the lower left side of the axis. Natural size.

Heliotype reproduction of photographs of the type specimens, numbers 19720 and 19722.



fication sphenophylloid. As a logical conclusion, she suggested that the Pteropsida should include the Cladoxylales and Filicales, the Lycopsida should include the Lycopodiales and perhaps also the Psilotales and Psilophytales, and the Sphenopsida should include the Articulatales and the Noeggerathiales.

If the Articulatales are joined with the Noeggerathiales in the Sphenopsida and the group contains non-articulated forms with non-verticillated phyllotaxy, then it seems to me that the Sphenopsida cannot be separated from the Lycopsida, and that Jeffrey's two groups are natural and inclusive enough to embrace all of the smaller groups excepting the Devonian Psilopsida, which have undifferentiated, leafless, rootless, dichotomized axes with terminal sporangia.

I was unable to interpret the American specimens of *Tingia* until the method of preparation described by Halle was applied to our specimens. He noted that "the rock always splits along the plane of the large leaves, one counterpart showing the impression on the upper side, the other that of the lower. . . . if the matrix bearing the impressions of the lower side of the large leaves, and of the axis, is removed, the smaller leaves are always found to be present." We were disposed to risk only two specimens of the nine available, because of the very fragile nature of the matrix. On both of these specimens the typical arrangement of the small leaves can be observed.

Halle has described three species: *Tingia carbonica* (Schenk) Halle, *T. crassinervis* Halle, and *T. partita* Halle. Kon'no has described two others from Korea, *Tingia hamaguchii* Kon'no and *T.elegans* Kon'no. He also recorded the occurrence of *T.partita* and *T. cf. carbonica* from Korea. All of the species are found in rocks of Lower Permian age.

Tingia taeniata *Darrah sp. nov.* 2 figures.

Shoot dorsiventral, frond-like, anisophyllous, with stout axis. Leaves arranged in four rows, two on the lower side of the axis and two on the upper side, the latter forming an angle of 30–45° with the axis. Leaves of the rows on the upper side large and spreading in one plane, gradually diminishing in size terminad. Apex of the leaves slightly dissected and lobed. Veins broad and conspicuous, bifurcating several times near the base of the leaf and running in parallel directions to the apex of the leaf.

The specific name indicates the linear, ribbon-like shape of the leaves.

This species is related to *Tingia carbonica* (Schenk) Halle, but it differs in its much stouter axis, coarser veins, and its more linear leaves. It may be compared with Halle's plate 62, figure 5 (Schenk's type of *Pterophyllum carbonicum*) and plate 63, figures 4 and 5. *Tingia taeniata* resembles *T. crassinervis* Halle in having a very stout axis and coarse veins, but differs in having more numerous veins and in the linear shape of the leaves.

Texas: Baylor County, 15 miles southeast of Seymour, on the Emily Irish land on the South side of Salt Fork of the Brazos River. Upper part of the Belle Plains Formation; Wichita Group; Permian, in my opinion. *Mrs. J. F. Kemp 19722, 19720* (Cotypes in Paleobotanical Collection, Botanical Museum of Harvard University).

Tingia kempiae *Darrah sp. nov.* 2 figures.

Shoot dorsiventral, frond-like, anisophyllous, with a very thick axis and four rows of leaves. Leaves of the two rows of the upper surface spread in one plane and forming an angle of 60–80° with the axis. Leaves with a broad base, oblong-oblanceolate, three to four times as long as the greatest width. Veins numerous (more than

ten), bifurcating several times near the base, and passing out into the leaf in parallel paths.

No details concerning the leaves of the two lower rows are known except their departure from the axis, which is similar to the departure of the leaves of the upper rows.

The species is named for Mrs. J. F. Kemp, in recognition of her generosity and helpful interest in the paleontology of the Texas Permocarboniferous.

TEXAS: Baylor County, 15 miles southeast of Seymour, on the Emily Irish land on the south side of Salt Fork of the Brazos River. Upper part of the Belle Plains Formation; Wichita Group; Permian, in my opinion. *Mrs. J. F. Kemp 19721, 19723* (COTYPES in Paleobotanical Collection, Botanical Museum of Harvard University).

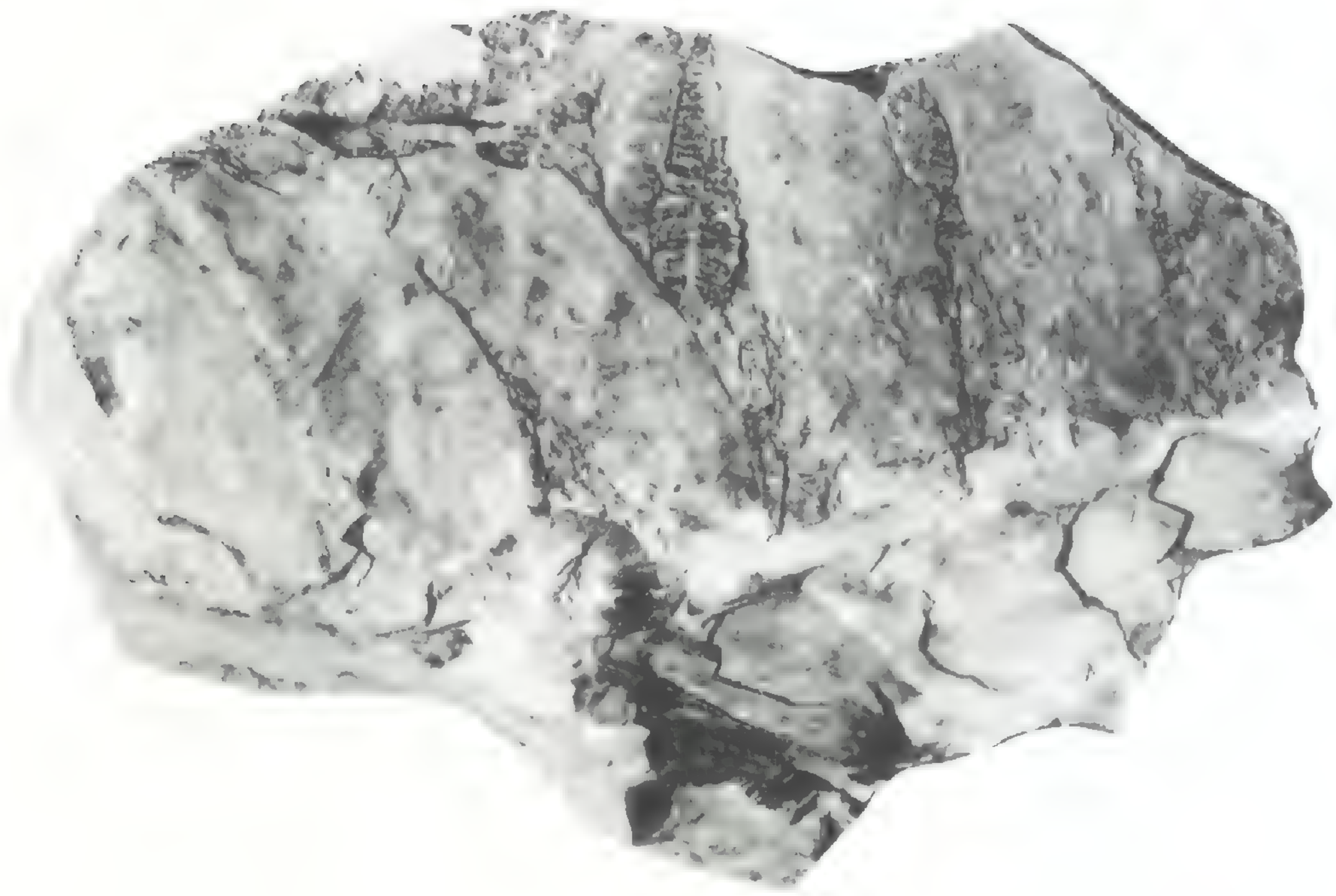
This species resembles *Tingia crassinervis* Halle, but differs in having broader leaves, more numerous veins, and a wider angle of departure. The figured specimens may be compared with Halle's plate 61, figures 1 and 3.

It is noteworthy that both of the American species bear relationship to *Tingia crassinervis* which occurs in the Upper Shihhotse Series of Shansi Province, China. *Tingia carbonica* occurs in the Lower Shihhotse Series of Shansi, and the two species are not found together. Halle concluded that at least the Upper Shihhotse Series belonged to the Lower Permian, and that the Lower Shihhotse probably belonged also within the Lower Permian. Halle[3] recently reported the discovery of *Tingia hamaguchii*, *Tingia carbonica* and *Tingia elegans* from the Nanshan Region (Kansu) of China, in rocks of Lower Permian age. The three species do not occur together, but appear in sequence in a thickness of 1200 meters.

The two species of *Tingia* from Texas occur in an interesting association composed chiefly of the following: *Odontopteris subcrenulata* (Rost.) Zeiller, *Pecopteris*

EXPLANATION OF THE ILLUSTRATION

TINGIA KEMPIAE *Darrah sp. nov.* Figure at top shows the stout axis and five leaves; points of attachment not preserved. One half natural size.
Figure at bottom. The specimen shows three leaves with venation preserved. Four fifths natural size.
Heliotype reproduction of photographs of the type specimens, numbers 19723 and 19721.



unita Brongniart, *Pecopteris hemitelioides* Brongniart, *Pecopteris candolleana* Brongniart, *Pecopteris arborescens* Schlotheim, *Taeniopteris sp.*, and *Walchia (Ernestia) sp.* The most significant form present is *Callipteris conferta* Goeppert. This last named species is recorded on the basis of two fine specimens.

The plant association in which *Tingia* occurs is in some particulars different from the so-called Permian flora. In common parlance, the Lower Permian flora is the "Red-bed" flora which presumably grew in an arid or semi-arid region. Although both *Walchia* and *Callipteris* are present, the abundant plants are ferns of the *Pecopteris* type.

The correlation of this florule is made simple because of the presence of *Callipteris* which is arbitrarily accepted as the indicator of Permian age. However, the preponderance of Carboniferous fern species warns of difficulty in drawing too fine a division. The Permocarboniferous floras are characterized by an admixture of ferns with such newer (i.e.younger) genera as *Walchia*, *Taeniopteris*, *Tingia*, *Gigantopteris*, and finally *Callipteris*.

In Asia there occurs a peculiar flora which may be identified by the presence of *Gigantopteris*. Consequently the region in which it occurs has been designated the "Gigantopteris Province", and the flora has been termed the "Gigantopteris Flora". Halle[10] has suggested that these names are inappropriate because the genus occurs for only a short time, the latest phase, in a far more extensive plant succession. For this more inclusive unit, he uses the name "Cathaysia Flora", after Grabau's Cathaysia land mass.

Gigantopteris occurs also in the American Southwest[11], in Texas and Oklahoma. Here again the vertical extent is remarkably limited. *Gigantopteris* in Texas is younger than *Tingia*[12], and it is noteworthy that *Gigan-*

topteris has been found at several localities without *Callipteris*. For example, at Fulda, Texas there occurs a florule with *Gigantopteris* but without *Callipteris*, which I have previously called "a *Callipteris* flora without *Callipteris*"[13]. The Fulda florule is certainly Permian.

Recently Jongmans and Gothan[14] have described a very similar Gigantopteris flora from Sumatra. *Tingia* and *Callipteris* are absent, and the flora is considered to be pre-Permian, that is Stephanian, and closely related to the oldest Shansi beds (Yemenkou Series).

The floras of eastern Asia and northwestern North America[15] have a considerable number of plants in common. The two land masses lie in proximity, and interchange of forms is inevitable, the rate of interchange being determined by climatic factors. In keeping with this logical approach to the problem of the distribution of *Gigantopteris* and *Tingia*, the only former route of interchange or migration was by way of Alaska, the Aleutian Islands, and Kamchatka. However, according to the Wegener Hypothesis of continental drift, which is one of the widely held concepts in geology, the problem is not so simple. It must be noted that few American geologists admit the hypothesis of continental drift, although the concept is almost universally accepted among European and southern hemisphere geologists. The thesis, stated in its simplest terms, involves the splitting apart of a single great continental mass into several parts —the existing continents—which gradually drifted to their present positions. The North American continent is assumed to have split off from Europe and is now more remote from its former points of contact than ever before. As the counterpart of this idea, the distance between Asia and western America has been decreasing, so that it is now less than ever before.[16]

The Belle Plains formation, in which *Tingia* occurs

in Texas, is in the upper part of Wichita Group. Romer[17] has given a full stratigraphic correlation chart of the Texas section. The Fulda florule is known from several localities, all in the uppermost part of the Belle Plains. This florule contains *Gigantopteris* and extends upwards into the Clyde formation, Clear Fork Group, and possibly higher.[18] These two florules are to be correlated with the Shihhotse Series of Shansi. It is difficult to compare them with the Korean section, but it appears that closest comparison should be made with the Kobõsan series (Jido of Kon'no).

David White was the first to point out the marked similarity between the late Carboniferous and early Permian floras of Asia and southwestern United States. Halle later observed that not only is this true, but also that even in the Appalachian Province there are Asiatic elements.[19] The discovery of *Tingia* in the Lower Permian rocks of Texas is another link in the chain of evidence pointing to the similarity between the contemporaneous Permocarboniferous floras of Asia and North America. The occurrence of *Tingia* and *Gigantopteris*, and similar genera, in these two regions also indicates that the Wegener concept of drifting continents is not necessary to explain this distribution. This phytogeographic problem, like most others, can best be explained on the basis of proximity of land masses and land bridges.

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